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LOGISTIC SUPPORT IN THE VIETNAM ERA

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A REPORT
BY THE JOINT LOGISTICS REVIEW BOARD

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PAUL H. RILEY
Deputy Assistant Secretary of Defense
(Supply, Maintenance & Services)

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CHAPTER I

INTRODUCTION

1. **BASIS FOR STUDY.** In connection with a review of worldwide logistic support to U. S. combat forces during the Vietnam era, the Terms of Reference of the Joint Logistics Review Board specify that particular attention be directed to "communications as it impacts on logistics."

2. **SIGNIFICANCE.** Timely, adequate, and accurate exchanges of information are prerequisites to effective, responsive, and economic logistic support. Logistic communications are crucial to the operations of logistics support forces—to port operations and delivery of material to operational units; to control of transportation on the land, on waterways, and in the air; to underway replenishment operations; and to the reactions of military construction forces to emergencies. Communications provide the means of expressing urgent requirements for supply of material, for planning repair work, for fuel and ammunition, and for technical assistance. Communications provide the links by which asset information and logistic action can be monitored by higher commands.

a. Although an allowance was made for the total volume of communications requirements for all purposes, a review of logistic support in the Vietnam era reveals instances in which the logistic planners appear to have assumed that adequate communications would be available but have later discovered deficiencies in the quantity or quality of communications desired or considered necessary. Even when requirements were fully recognized, the delay in acquiring capabilities was long—particularly where fixed communications were concerned.

b. Stimulated by trends toward greater centralization of controls, the desire for more detailed information at additional levels, and the expanding capabilities of automatic data processing (ADP) equipment to handle vast quantities of data, demands for communications increased rapidly during the period reviewed in this monograph. Plans for new sophisticated logistic information and management systems portend difficult problems for the future.

c. In the future the logistician must have a sound understanding of communications capabilities, limitations, and costs, and must be able to incorporate these considerations in plans to an extent far beyond that which was customary in the past. The demands for information and the design of systems must take these facts into consideration, and overall plans for communications must increasingly consider the specific needs of logistics.

3. **STUDY OBJECTIVES.** The objectives of this study are to:

a. Identify the interrelationship of communications and logistic support operations with special emphasis on the implications of trends in logistic automatic data processing systems.

b. Determine means of enhancing logistic communications readiness in preparation for future contingencies.

4. **SCOPE OF THE REVIEW**

a. This monograph reviews and evaluates the ability and adequacy of the military communications systems to provide communications for logistic support of U. S. combat forces in South Vietnam from 1 January 1965 to the present. This review also includes communications contingency assets and their deployment, limitations, and eventual replacement with fixed-plant

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communications. Special attention is given to the ability of contingency communications to support logistic elements in future deployments.

b. During the past decade, requirements for the transmission of digital data have substantially increased. In addition, the echelon at which data transmission is originated has been steadily lowered. This development has placed requirements on field communications which differ from the previous requirements for voice transmission. These requirements for digital data transmission are increasing as automation is applied to more and more tasks, and the corresponding data requirements are reduced to digital form closer and closer to the source of the data. Recognizing this factor, major emphasis has been placed on the digital data transmission aspects of communications.

c. Because logistics is only one of many users of communications, this review includes broad coverage of much of the spectrum of communications, focusing more specifically on those segments of major significance to logistics. There has been no attempt to study deeply the individual Service communications problem.

d. This monograph is oriented toward the service provided to the users and the methods used to provide this service. Emphasis is on the adequacy and suitability of the communications capability to support logistics and the responsiveness of communications to logistics. As such, command relationships and responsibilities are discussed only insofar as they affect the service provided to the user.

5. ORGANIZATION OF THIS MONOGRAPH

a. Chapter II develops the historical background pertinent to understanding the major issues that are discussed in subsequent chapters. This chapter is supported by Appendixes A through E in which the detailed actions are reviewed.

b. Chapter III is concerned with the detailed development of logistic communications requirements.

c. Chapter IV discusses the current ability of the Services to provide communications for the support of logistics during contingency operations.

d. Chapter V examines the actions taken to acquire the capability to provide high-capacity, high-quality communications using transportable equipment in lieu of fixed-plant facilities.

e. Chapter VI explores the problems involved and the coordination required between the ADP systems plans and the supporting communications.

CHAPTER II

HISTORICAL REVIEW

1. **INTRODUCTION.** This chapter presents the historical background essential to understanding the major issues that are discussed in subsequent chapters. A review is made of the initial communications posture, including systems descriptions, capabilities, limitations, and significant problem areas. From this review base, the communications buildup is further detailed, including a discussion of deployment of contingency assets and the use of fixed-plant equipment.

2. **SCOPE.** In examining the communications provided to support logistics in South Vietnam, it became apparent that unique communications facilities for the sole or major support of logistics were not planned to be provided as a separate or distinct system. ^{1, 2} Communications for logistics were to be provided in conjunction with those provided for other users, by common-user communications systems. Therefore, the substance of this chapter is devoted primarily to the buildup of the common-user systems in RVN. The depth of treatment in this chapter is restricted in order to maintain an overall view; the detailed information supporting this chapter is included in the appendixes.

3. **INITIAL SITUATION.** In reviewing the communications posture at the start of the buildup in 1965 and the actions taken in response to changing requirements, it is important to note that unlike other possible contingency situations, U. S. forces were already in Vietnam and some communications capabilities existed. ³ Contrary to past experience, however, the combat and communications zones were indistinguishable and encompassed an entire country in which there were no large areas secure from enemy action.

a. **Force Distribution.** At the beginning of 1965 there were 14,697 U. S. Army personnel in RVN. Approximately one-third of that number were assigned to an advisory role or as staff support to the advisory effort; the remaining two-thirds were engaged in combat support or combat service support roles. Of approximately 1,100 Navy personnel in RVN, 499 served as advisors; the remainder were engaged in providing logistic support and service as the MAAG "Administrative Agency" in the Headquarters Support Activity, Saigon. Most of the Air Force's 4,400 personnel were occupied with training and developing the Republic of Vietnam Air Force (RVNAF). Its aircraft inventory consisted of 220 aircraft operating from three bases. The vast majority of approximately 700 Marines in-country were directly involved in the operation of a medium helicopter squadron providing support to RVNAF. ⁴

b. **Theater Responsibilities.** The Defense Communications Agency midrange plan of 1962, as approved by the Secretary of Defense, had assigned responsibility for Defense Communications System (DCS) circuits in Vietnam to the U. S. Army. ⁵ This plan had been further

¹Operation plans covering specific situations of major U. S. force commitments in RVN did not provide for unique communications for logistics, but for operational and common-user communications only.

²The definition, validation, and provision of the requirements of logistics for supporting communications are addressed in detail in Chapter III.

³See Appendix A (Background to 1 January 1965) for details of the communications situation prior to 1965.

⁴Commander in Chief, Pacific (CINCPAC). Command History 1965 (Annex A, USMACV) (U), 13 May 1966, p. 3 (TOP SECRET).

⁵Defense Communications Agency (DCA) Memorandum, subject: DCS Mid-Range Plan, Defense Communications System 1962, 16 January 1963.

supplemented in 1963 by an Army-Air Force agreement by which the Army was to provide long-haul service and the Air Force was to provide local service at five specified locations. However, plans in 1964 called for the reduction of the U. S. forces during the following year. As a result, communications planning was oriented toward turning the existing communications over to the RVN. Up to June 1964, when events indicated the questionable validity of the above plans, all efforts had been directed toward phasing out U. S. communications as quickly as possible. The majority of the tactical equipment was to be turned over immediately to the RVN armed forces, whereas the operation and maintenance of the BACK PORCH tropospheric scatter radio system was to be assumed by the South Vietnamese as quickly as their capability could be developed.⁶

c. Communications Capabilities. The communications capabilities existing on 1 January 1965 are described below.

(1) Out-of-Country

(a) Prior to 1965 communications out-of-country consisted primarily of high frequency (HF) radio to the Philippines, Thailand, Okinawa, and Japan. These HF systems were substandard due primarily to the lack of clear frequencies in this area.⁷ The circuits provided were not able, in terms of quality and quantity, to support the data systems essential to logistics deployment.

(b) On 1 January 1965 a 60-voice channel submarine cable (WET WASH), extending from San Miguel in the Philippines to Nha Trang, RVN, was placed in service. In Vietnam the cable was extended from Nha Trang to Phu Lan by a 60-voice channel AN/MRC-85 10-kw tropospheric scatter radio (tropo) link. At San Miguel it could be connected to the commercial Trans-Pacific cable (TRANSPAC) for circuits to Guam, Midway, Hawaii, Japan, and the United States.⁸ The cable was inherently reliable and provided high-quality circuits, but was subject to being cut, in which case the only alternate paths to the east were by satellite and HF radio.

(c) The existing SYNCOM satellite system could furnish only one voice and one teletype channel, both on a part-time basis. This program was being supported at the Saigon end with an experimental model terminal and, although an emergency capability from Saigon to California had been provided on 24 August 1964, the major use of the satellite circuits was for engineering and operational test.⁹ In addition, due to an inherent time delay for parity checks, maximum data speed was limited to 50 cards per minute.¹⁰

(d) A particularly difficult situation existed regarding communications to Okinawa, which had been assigned responsibilities for logistic support of Army and Marine units in RVN. Efforts to extend the WET WASH cable via troposcatter radio links from the Philippines to Okinawa had not been successful.¹¹ Dependence had to be placed on the inadequate and

⁶CINCPAC, Command History 1965, op. cit., p. 104; CINCPAC, Command History 1964 (Annex A, USMACV) (U), undated, p. 351 (TOP SECRET); United States Army, Pacific (USARPAC), History of U. S. Army Buildup and Operations in the Republic of Vietnam (RVN), 1 February to 31 December 1963 (U), 11 March 1964, pp. 24-35, 220 (TOP SECRET); USARPAC, History of U. S. Army Operations in Southeast Asia, 1 January 1964 to 31 December 1964 (U), 30 April 1965, pp. 158-161, 163 (TOP SECRET).

⁷CINCPAC, Command History 1964, op. cit., p. 351; History of U. S. Army Buildup and Operations in the Republic of Vietnam, 1 February 1963 - 31 December 1963, op. cit., pp. 299-331; Defense Communications Agency, DCA 1964 Commanders' Conference Report (U), undated, p. 40 (CONFIDENTIAL).

⁸Defense Communications Agency, Annual Report of the Director for the Period 1 July 1964 - 30 June 1965 (U), 12 August 1965, pp. V, 13, 14 (SECRET).

⁹Ibid., pp. 24-27.

¹⁰DCA 1965 Commanders' Conference Report (U), op. cit., pp. 39, 42, 50, 330-331.

¹¹Ibid., p. 47.

unsatisfactory HF links between Vietnam and Okinawa, because there were no alternate electrical means available.

(e) The two major out-of-country communications problems that directly impacted on logistic users were:

1. The acquisition of sufficient alternate routing to the east to sustain the loss of the submarine cable.

2. The provision of high-quality circuits to Okinawa.

(2) In-Country Long Lines. The long lines circuits were provided by the following systems.¹²

(a) The BACK PORCH tropo system (a 72-voice channel system utilizing transportable AN/MRC-85 equipment) extended from Saigon to Nha Trang, Qui Nhon, and Da Nang; and from Nha Trang to Pleiku and Ubon, Thailand. (See Figure 1.) Although providing the major communications links, this system had the following serious problems.

1. The sites had been chosen for security reasons and not for propagation characteristics. As a result, the channels did not meet DCS standards.

2. The technical control facilities were inadequate to provide supervision over the circuits.¹³ As a result, troubleshooting procedures could not be adequately implemented and circuit restoration actions were severely hindered.

3. There was a shortage of channels from Saigon to Nha Trang that restricted access to the north.¹⁴

4. There was a significant degree of vulnerability to enemy action at Nha Trang. At that critical point, the links to Saigon, Qui Nhon, Da Nang, and Pleiku all came together.

(b) Tactical tropo links extended from Saigon to Soc Trang, Saigon to Vinh Long, and from Saigon to Gia Nghia, Ban Me Thout, and Pleiku. Other tactical tropo links extended from Da Nang to Quang Ngai and Da Nang to Hue. (See Figure 2.)

(c) A Vietnamese commercial system built by the Agency for International Development (AID) called SOUTHERN TOLL, linked Saigon with My Tho, Vinh Long, Can Tho, Soc Trang, Long Xuyen, and Rach Gia. (See Figure 3.)

(d) Very high-frequency (VHF) and microwave tactical equipment extended circuits from the above systems. This extension of the long-haul system by the use of tactical equipment caused substantial technical incompatibility problems (e. g., differences in levels and ringing frequencies) that resulted in degradation of circuits as they were extended from one link to another. The tactical equipment, built to be rapidly emplaced and to provide basic voice communications, was not designed to provide the low noise levels required by the DCS and essential to accurate digital data transmission. The configuration of the fixed-plant long-haul system could not be rapidly changed to meet the tactical user's requirements without incurring degradation.

¹²Command History 1965, *op. cit.*, pp. 377-378.

¹³G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), draft dated 11 May 1969, pp. 15-16 (CONFIDENTIAL).

¹⁴CINCPAC, Command History 1964 (Annex A USMACV (U)), undated, p. 178 (TOP SECRET); G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950 - 1967 (U), draft dated 22 May 1969, p. 19 (CONFIDENTIAL).

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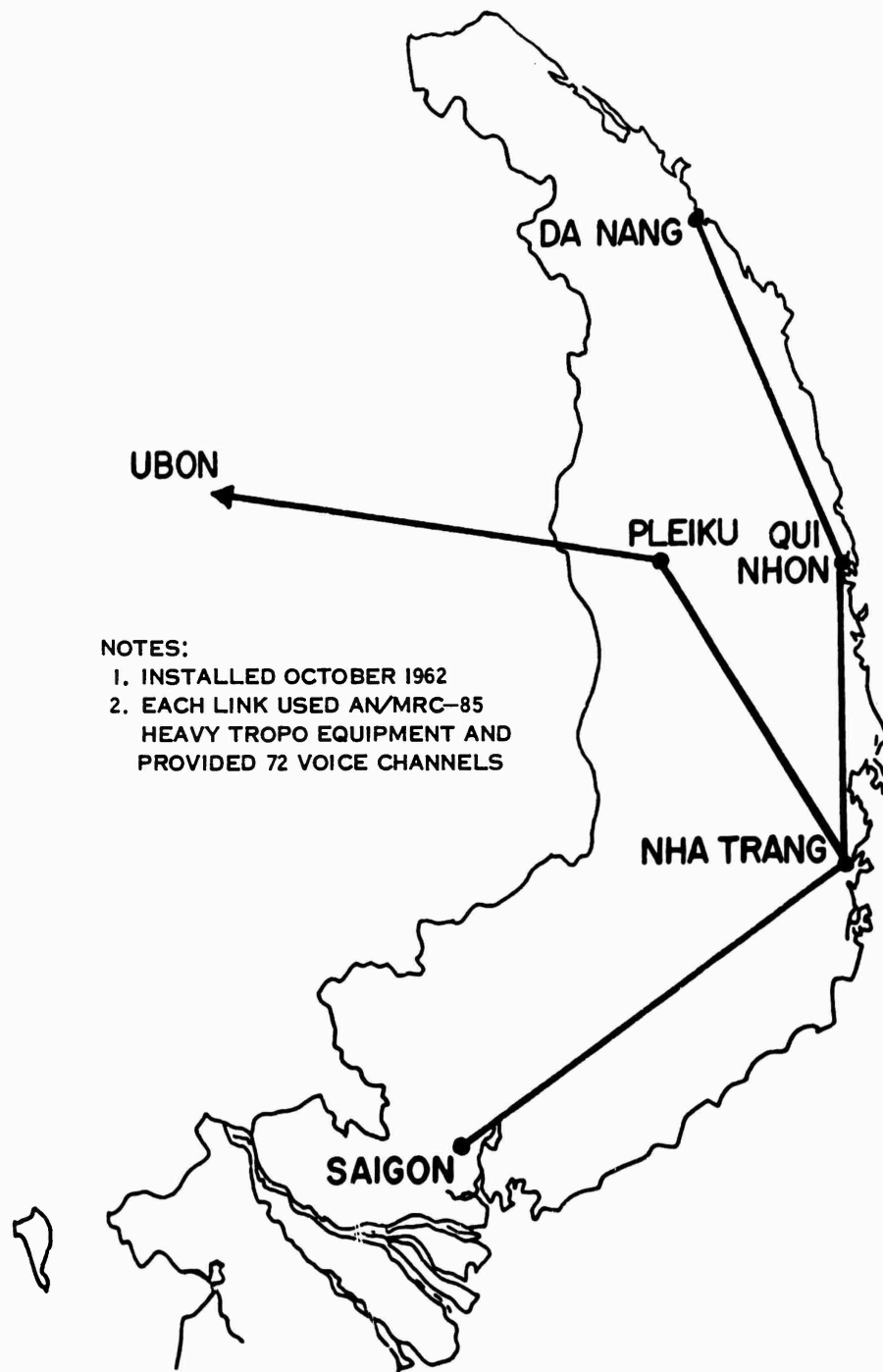


FIGURE 1. BACK PORCH SYSTEM - 1 JANUARY 1965

Sources: USARPAC, History of the U.S. Army Buildup and Operations in the Republic of Vietnam (RVN), 1 January 1961 to 31 January 1963 (U), 18 November 1968, pp. 161-162. (TOP SECRET).

CINCPAC, Command History 1965 (Annex A USMACV) (U), 22 May 1966, p. 377 (TOP SECRET).

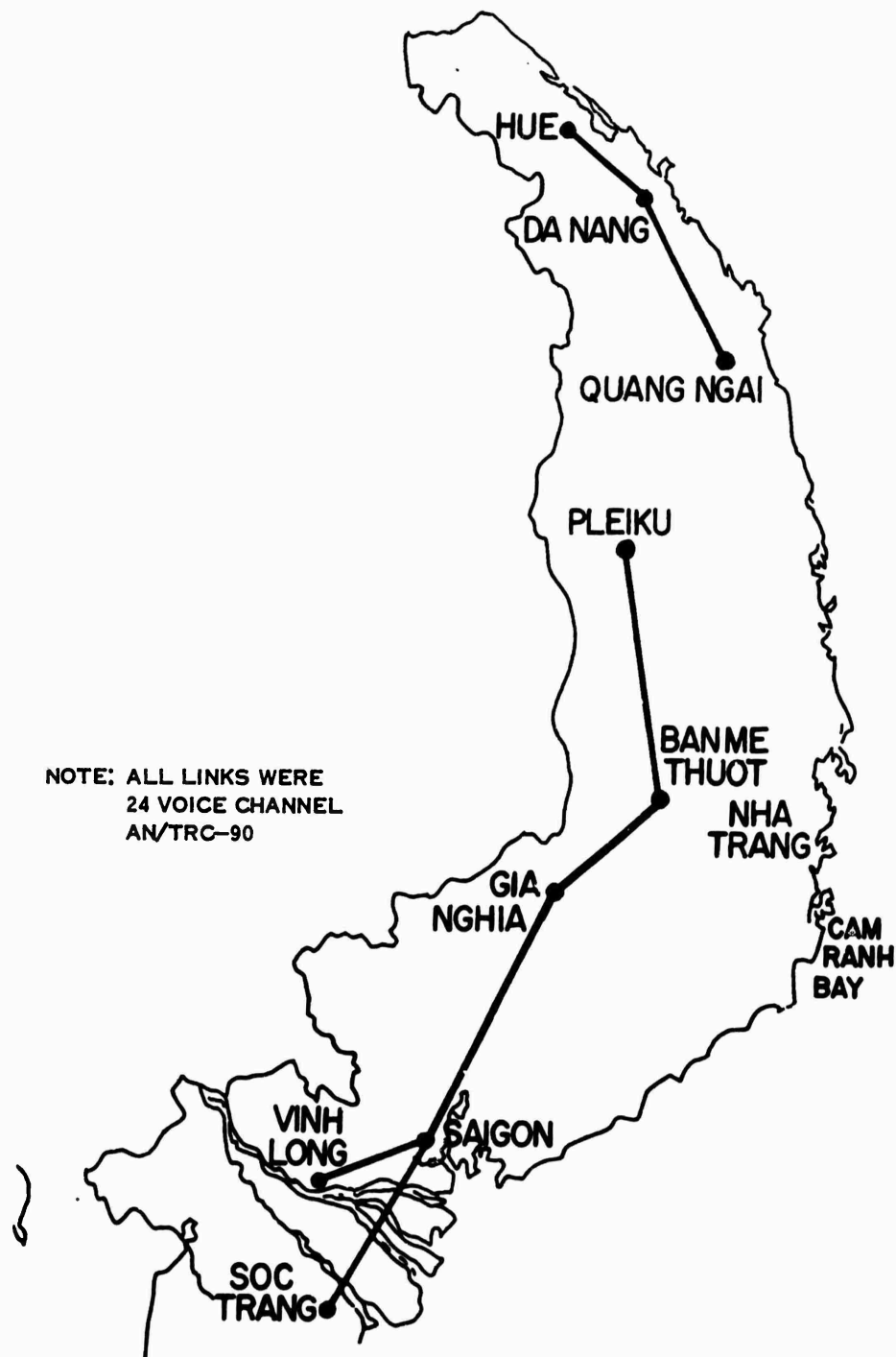


FIGURE 2. TACTICAL TROPO NETWORKS - DECEMBER 1964

Sources: USARPAC, History of the U. S. Army Buildup and Operations in the Republic of Vietnam (RVN), 1 January 1961 to 31 January 1963 (U), 18 November 1968, pp. 161-162 (TOP SECRET).

G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969, pp. 10, 11, and 13 (CONFIDENTIAL).

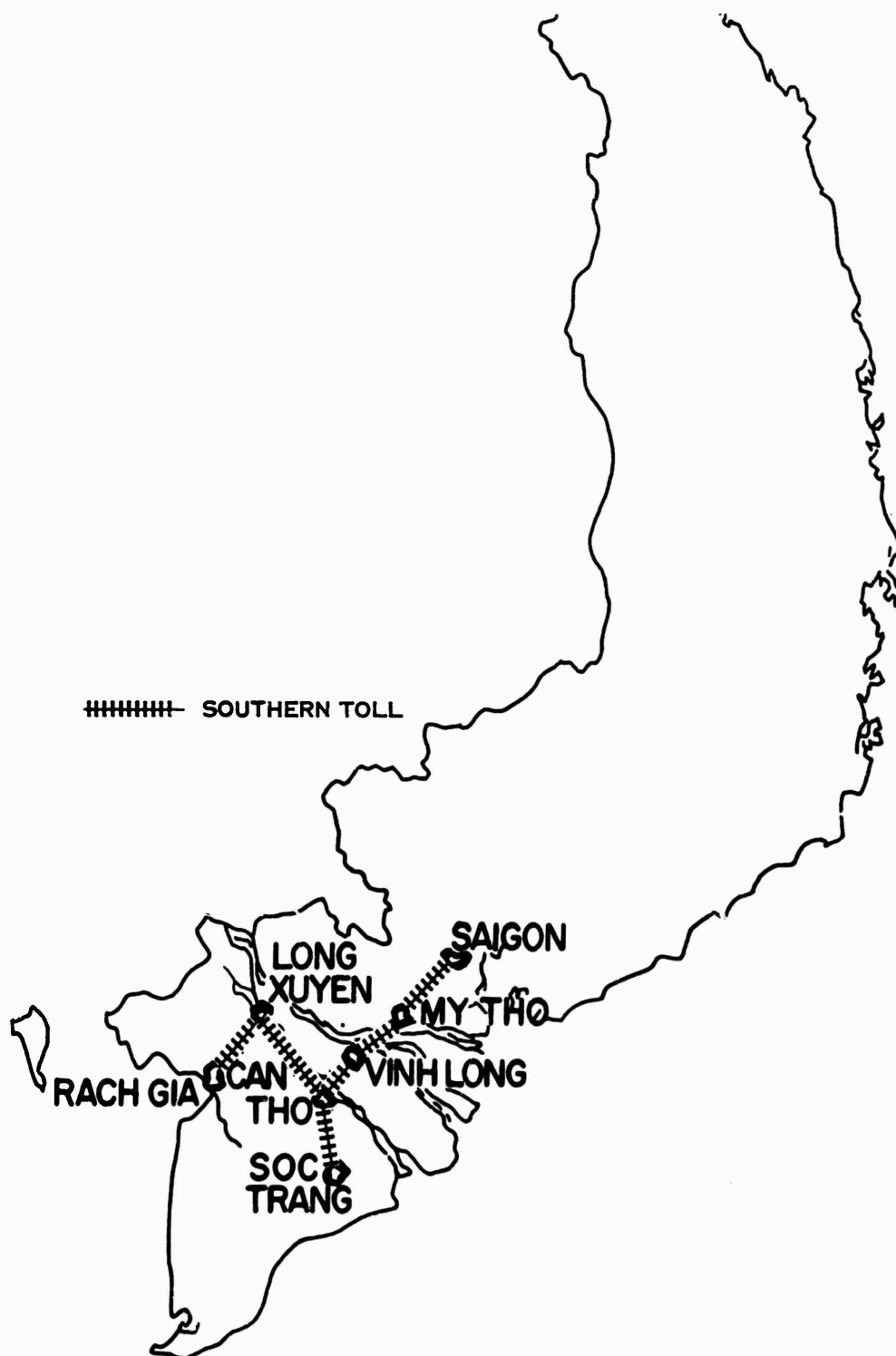


FIGURE 3. SOUTHERN TOLL COMMERCIAL COMMUNICATIONS SYSTEM –
1 JANUARY 1965

Source: CINCPAC, Command History 1965 (Annex A USMACV) (U), 2 May 1966, p. 378 (TOP SECRET).

(3) Voice Switching Networks. The military telephone system in Vietnam was a hodgepodge of duplicating trunks, poor circuitry, and overlapping responsibilities.¹⁵ It was basically a tactical system devoted primarily to the local areas where U.S. forces were based. An effective long-distance voice-switching service did not exist.

(4) Message Switching Networks. Difficulties were encountered at the major tape relays serving Vietnam. At Phu Lam, the only major tape relay in RVN, the ability to handle overloads did not exist. For example, during the August 1964 crisis in the Tonkin Gulf, Phu Lam handled a monthly total of 3,265 flash messages, an average of over 105 daily with a peak of 258 in 1 day. As the Chief of the Defense Communications Agency, Pacific (DCA-PAC), reported: "Lower precedence messages didn't have a chance."¹⁶ The facilities of the Defense Communications System (DCS) facility at Clark AB, the gateway to SE Asia, were outdated and saturated. Among other improvements in the Philippines portion of DCS, Project SPEED QUEEN had been initiated to provide relief for this situation, but the tape relay portion would not be completed until 24 February 1966.¹⁷

(5) Fleet Communications

(a) In the SE Asia theater-of-operations, the U.S. Navy operated the customary fleet broadcasts, ship-to-ship and ship-to-shore communications for units of the Seventh Fleet. Traffic destined for fleet units was passed by means of the fleet broadcast that all ships are required to copy. This broadcast was keyed by Naval Communications Stations (NAVCOMMSTAs) that covered designated ocean areas. Naval ships at sea passed their outgoing traffic to the nearest NAVCOMMSTA, which was responsible for relaying it to addressees. As of 1 January 1965, NAVCOMMSTAs Philippines, Guam, and Japan were principally involved in providing communications for the Seventh Fleet.

(b) The extensive deployment of major fleet units to the coastal waters off Vietnam placed an increasing burden on existing facilities. The large volume of message traffic for the Seventh Fleet, coupled with the major reliance on NAVCOMMSTA Philippines and the lack of multi-channel broadcast and on-line ship-to-ship and ship-to-shore equipment on a majority of the ships, resulted in excessive traffic backlogs.¹⁸

(c) The special UHF and MF/HF circuits dedicated to underway coordination of replenishment operations proved adequate. However, modern radio single sideband equipment with frequency synthesized transmitters and receivers had not been installed on Service Force ships, thus hampering their logistic operations. There was also a lack of suitable equipment, both afloat and ashore, for the transmission of logistic digital data via HF radio systems.¹⁹ Although communications readiness for Navy and Marine Corps amphibious operations involving over the shore logistic support had proved satisfactory in exercises of short duration, the capability for sustained follow-on-logistic support had not been tested.

(6) Actions to Resolve. By 1 January 1965, MACV had identified to CINCPAC two major communications areas in which serious deficiencies existed. These were the in-country long lines systems and the telephone networks. Requirements of logistical elements for communications were not uniquely identified. The identification of requirements by MACV to CINCPAC was on an overall basis without any separation of needs as to functions, e.g., logistical, administrative, and operational.

¹⁵History of U. S. Army Operations in Southeast Asia, 1 January 1964 to 31 December 1964 (U), op. cit., p. 162.

¹⁶1964 Commanders' Conference Report (U), op. cit., p. 40.

¹⁷Ibid., p. 42; Defense Communications Agency - Southeast Area Region General Information Booklet (U), dated 1 July 1966 as amended by two changes dated 1 February 1967 and 3 April 1967, p. 3-1 (CONFIDENTIAL).

¹⁸Chief of Naval Operations (CNO) OP-441P Memorandum, 29 May 1969, Ser 00372P094.

¹⁹OP-942 Memorandum, subject: Study of ADP Impact on Naval Communications, 8 April 1969.

4. THE BUILDUP. The large-scale commitment of U.S. forces in 1965 was accompanied by a major effort to improve the communications systems required to support the operational and logistical demands of the buildup.²⁰ The influx of the logistics organizations into Vietnam beginning in March 1965 served to focus attention on an already overburdened communications system. Logistic systems that relied heavily, if not entirely, on high-speed data transfer over a well-established automatic switching network in CONUS, with voice and teletype service available to provide essential narrative traffic and personal contact, were now thrust into an environment where logistic demands and problems were multiplied and the communications service essential for operations was minimal.

a. Out-of-Country.²¹ Two major problems affected out-of-country communications. These were the lack of sufficient alternate routing capacity to sustain the loss of a major link (the WET WASH or TRANSPAC submarine cable) and the lack of a reliable high-quality path to Okinawa.

(1) The HF systems were expanded using contingency equipment to provide backup to the WET WASH cable by the addition of circuits to Clark AB, San Miguel, and Guam. Some difficulties were experienced with these circuits because a lack of adequate real estate in RVN limited the size of the antenna fields and the types of antennas that could be installed, which in turn affected their performance and reliability.

(2) Three satellite programs provided out-of-country communications support.

(a) The SYNCOM system, which had been established in RVN as an emergency measure, completed its engineering and test period and became fully operational in July 1966. The terminal station at Saigon provided one voice and one teletype channel to the east. By December 1967 it had been phased out of Vietnam and had been replaced by IDCSP (Initial Defense Communications Satellite Program).²²

(b) Diversion of IDCSP assets from a research and development program was approved by the Secretary of Defense in April 1966. The Pacific portion serving Vietnam became operational in July 1967, with a terminal at Saigon and one at Nha Trang. Initially each terminal could provide five voice channels;²³ they were later modified to provide 11.²⁴ Ship-board terminals of the IDCSP were also installed on specified ships of the Seventh Fleet.

(c) The COMSAT commercial satellite system provided six voice channels from Hawaii to Thailand where they were connected to the 439L cable and extended to Saigon. This system was activated in May 1967 and is still in use.²⁵

(3) An additional out-of-country system was provided via the Bangkok-Saigon tropo link. This link, planned in 1962,²⁶ was activated in late 1965 but required extensive improvement

²⁰A detailed account of the actions during 1965 to DOD, JCS, CINCPAC, and MACV levels concerning commitment of forces to RVN is presented in Institute of Defense Analysis Report R-137, Southeast Asia Force Deployments Buildup (U), March 1968 (TOP SECRET).

²¹See Appendix B (Buildup of Out-of-Country Links) for detailed information.

²²Regional Communications Group, 1st Signal Brigade (STRATCOM), IWCS Orientation, Second Edition, 1 April 1968, p. XVI-1.

²³Defense Communications Agency, Annual Report of the Director for the Period 1 July 1966 - 30 June 1967 (U), undated, pp. 5, 101, 102 (SECRET).

Defense Communications Agency - Southeast Asia Mainland Region, Commanders' Report, 1 July 1966 - 1 July 1967 (U), undated, Section II-5 (CONFIDENTIAL).

1st Signal Brigade Letter, subject: Operational Report for Quarterly Period Ending 31 July 1967 (U), 14 August 1967, p. 9 (CONFIDENTIAL).

²⁴Defense Communications Agency, Annual Report of the Director for the Period 1 July 1967 - 30 June 1968 (U), 14 August 1968, pp. 117, 118 (SECRET).

²⁵Annual Report of the Director for the Period 1 July 1966 - 30 June 1967, op. cit., pp. 103, 104.

²⁶G.R. Thompson, op. cit., p. 25.

before becoming satisfactory for voice traffic. After improvement this link was only marginally effective for teletype traffic.²⁷

(4) The capability of the out-of-country systems to sustain the loss of a major link was demonstrated on 25 August 1967, when the TRANSPAC cable was broken and remained inoperative for 10 days. During that period 46 voice-equivalent circuits were restored using other media.²⁸

(5) Various efforts were made to establish a high-quality path to Okinawa for common-user data traffic. In June 1967 this was resolved by providing a circuit from Vietnam to the Philippines via the WET WASH cable, there to Hawaii and Japan by submarine cable, and then to Okinawa by tropo. However, up to July 1967, air courier remained one of the major means used to carry card traffic to Okinawa.

b. In-Country Long Lines²⁹

(1) Recognizing the limited capability of the existing backbone communications system to support the military effort, requirements were prepared and forwarded to the Joint Chiefs of Staff in October 1964 to upgrade it in terms of channel capacity, quality, and extension of service.

(2) The basic approach was to contract for fixed-plant tropo and microwave radio links with associated technical control facilities. This was designated as Phase I of the Integrated Wideband Communications System (IWCS). This system was initially designed to meet the requirements of a force of approximately 40,000 men.³⁰ As the force level was increased, IWCS was programmed for further improvements and Phase II (designed to provide for 200,000 troops) and Phase III (designed to provide for 400,000 troops) were initiated.³¹ (See Figure 4.)

(3) A second major long-haul system was provided when the 439L Coastal Cable Project was completed by Air Force contract in May 1967. The project, initiated in November 1965,³² connected major installations from Da Nang, RVN, to Sattahip, Thailand, via submarine cable. Cableheads were constructed at Da Nang, Qui Nhon, Nha Trang, Cam Ranh Bay, Vung Tau, and Sattahip. Microwave links joined the cableheads with IWCS terminals. (See Figure 4.)

(4) Substantial delays were encountered in achieving the desired high-quality, high-capacity long-haul systems. These delays were caused in part by the revision of requirements as the troop buildup proceeded and delays in equipment acquisition and construction problems. (For a more complete discussion of these major problems see Appendix C and the Construction Monograph.)

(5) The first circuits were cut over on the new fixed-plant system in December 1966, and the problems in the major communications bottleneck, Saigon - Nha Trang, began to decrease in March 1967.

(6) Pending completion of the IWCS and the 439L Coastal Cable Project, heavy and light transportable contingency tropo equipment, together with additional microwave and VHF radio terminals, were deployed to expand existing facilities. By December 1967, the long-haul

²⁷ Annual Report of the Director for the Period 1 July 1965 - 30 June 1966 (U), op. cit., pp. 4, 14.

²⁸ Defense Communications Agency, Presentation by the Chief, DCA-PAC, to the DCA Commanders' Conference on 5 October 1967.

²⁹ See Appendix C (Buildup of RVN Long Lines) for detailed information.

³⁰ Phase I of the IWCS was designed to provide the communications capability identified in CINCPAC Operations Plan (USARPAC, History of the U.S. Army in Southeast Asia, 1 January 1965 - 31 December 1965 (U), 13 September 1966, pp. 148-165 (SECRET).

³¹ Defense Communications Agency, Memorandum for the Director, Telecommunications Policy (Installation and Logistics), subject: Fact Sheet for LCA IVCS Briefing, 8 May 1968, 7 May 1968, p. 1.

³² Command History 1965, op. cit., pp. 385, 387-8.

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FIGURE 4. 439L AND IWCS THROUGH PHASE III

Source: USARPAC, Communications Evaluation in Southeast Asia (COMSEA) (U), 17 June 1969, p. C-37 (CONFIDENTIAL).

system in Vietnam included over 100 links provided by tactical mobile/transportable equipment. This was over and above the 130 links in tactical areas systems at that time.

c. Voice-Switching Networks³³

(1) The basic voice-switching system simply grew and multiplied during 1965 to meet the needs of commands with little or no overall management.³⁴ Manual switchboards were unable to provide either the quality or quantity of service required, yet in most instances these switchboards, some with only a 60-line capacity, were used to provide both local and long-distance switching service. The demands of subscribers and the volume of traffic precluded the proper supervision of each call through to completion.³⁵ There were frequent problems because two-wire switchboards are generally unsatisfactory over long-distance trunks when routed through three or more switches.³⁶ Overworked operators and overworked equipment contributed markedly to subscriber frustration, which in turn prostituted the priority system and generated demands for more dedicated circuits.

(2) A series of actions were taken to provide relief.

(a) Local low-capacity switchboards (SB-22, SB-86) were gradually phased out as multi-position switchboards with a 200 or more line capacity were obtained and cut into service. At the time that plans had been initiated in 1964 to upgrade the telephone system, it was intended to place dial central offices (DCOs) in operation, where appropriate. This resulted in the award of contracts for fixed-plant installations. Acquisition of this capability was delayed due to construction problems, including installation of an outside plant. The initial fixed-plant DCOs provided by contract were cut into operation during 1967. By the end of 1967, 29 fixed-plant DCOs with a total capability of over 34,000 lines, were in operation in RVN. In addition, transportable DCOs were fabricated in CONUS and sent to RVN. As these became available they permitted the large manual, transportable switchboards to be relocated and replaced by small tactical boards.

(b) In September 1965, DCA-PAC was tasked to provide a system plan for automated telephone service in SE Asia.³⁷ This plan, approved by DOD in April 1966, provided for four-wire automatic long-distance switchboards, the Tandem Switching Centers. The first of these switches was cut over to service in RVN in February 1969.

(c) Pending the construction of the Tandem Switching Centers, other measures were initiated to improve the long distance service. These measures included centralization of trunks into manual long-distance switchboards, improvements in signaling techniques, and use of class "A" - class "C" service. Although improvements were achieved, as of January 1969 the basic long-distance service was unsatisfactory.³⁸

d. Message Switching.³⁹ The expansion of the long-haul communications system was accompanied by an expansion of the teletype switching system required to serve the growing number of subscribers and the further development of a manual relay network to transmit electrically data on punched cards.

³³ See Appendix D (Buildup of Voice-Switching Networks in RVN) for detailed information.

³⁴ Commander's Report, 1 July 1966 - 1 July 1967 (U). op. cit., Section II, Tab II.

³⁵ Ibid.; Joint Chief of Staff (JGM 585-69) Memorandum for the Chairman, Joint Logistics Review Board, subject: Communications Problem Areas (U), 11 June 1969 (CONFIDENTIAL).

³⁶ Ibid.; This effect of two-wire switches is documented in detail in TM 11-486-1, -11 series.

³⁷ USARPAC, History of the U. S. Army Operations in Southeast Asia, 1 January 1965 to 31 December 1965 (U), 13 September 1965, p. 183 (TOP SECRET).

³⁸ Brig. Gen. W. M. Van Harlingen, Debriefing Report (U), 18 January 1969, pp. 35-37 (CONFIDENTIAL).

³⁹ See Appendix E (Buildup of Message Switching Networks in RVN) for detailed information.

(1) Teletype

(a) The initial major torn tape relay in RVN, located at Phu Lam, was expanded from 30 to 52 lines before the end of 1965 and to 72 lines in 1966.⁴⁰ An interim major torn tape relay, employing transportable contingency equipment from STRATCOM-CONUS, was established at Nha Trang in November 1965. In April 1966 the transportable equipment was replaced by a fixed-plant installation with an eventual capacity of 44 lines.⁴¹ A third major torn tape relay, employing the same units and equipment, was established at Da Nang in a sequence of actions closely paralleling those at Nha Trang. This interim facility was activated in December 1966 and was replaced with a fixed-plant facility in April 1967.⁴² Line capacity was increased from 24 to 48 by January 1968.

(b) Teletype service was substantially degraded by a lack of communications discipline on the part of the users. Flash traffic during this period was extremely high. On 21 August 1966, 606 Flash messages were processed by the Phu Lam and Nha Trang major teletype relays. The number was 719 on 26 August 1967.⁴³ The effect was to cause increased handling time of messages with lesser priorities at all stations.

(2) Data

(a) By 1964 the requirement to pass digital data between RVN based organizations and supporting organizations and facilities in the Pacific and CONUS had resulted in the development of a data transmission network that was devoted primarily to support of the logistic system.

(b) The increasing demands for more and better data transmission capabilities resulted in an urgent requirement being initiated by COMUSMACV in 1965 for an improved data transmission system, which resulted in the expansion of interim AUTODIN. The manual data relay at Phu Lam was expanded and a second manual data relay was activated at Nha Trang in 1967.⁴⁴

(c) In March 1968 the Phu Lam AUTODIN Automatic Switching Center (ASC) was activated, and in June 1968 the Nha Trang ASC was activated. With the activation of these relays, AUTODIN became fully implemented in RVN.⁴⁵ These activations, together with the previously acquired high-quality fixed-plant communications links, resolved the message switching problems.

e. Fleet and Naval Support Communications. The increased tempo of naval operations in 1965 caused the message traffic loads to exceed the capabilities of communications facilities. Action was accelerated in July 1965 to improve fleet broadcast and ship-to-shore capabilities in the Western Pacific. The facilities of WESTPAC NAVCOMMSTAs were expanded and upgraded, and the major communications relay ships, USS ANNAPOLIS (AGMR-1) and USS ARLINGTON (AGMR-2), were deployed to the waters off Vietnam in August 1965 and August 1967, respectively, in order to alleviate circuit saturation and resultant traffic backlogs. Steps were taken to develop a ship-to-shore data transmission system in WESTPAC using HF radio, but the system was not capable of supporting more than a low speed transmission rate (6 to 10 cards per minute). To fill the need for fixed fleet communications capability ashore in RVN, the following communications projects were undertaken.

⁴⁰G. R. Thompson, op. cit., pp. 50-58.

⁴¹Ibid; USA STRATCOM, History of the U. S. Army Strategic Communications Command FY 1966 (U), undated, p. 18 (CONFIDENTIAL).

⁴²1st Signal Brigade Letter, 14 August 1967, op. cit., p. 10.

⁴³Presentation by Chief, DCA-PAC, op. cit.

⁴⁴Defense Communications Agency, 1966 DCA Commanders' Conference Report (U), September 1966, p. 90 (CONFIDENTIAL).

⁴⁵IWCS Orientation, op. cit., p. XIV-1.

(1) Project BOW LINE, initiated in July 1965 to provide facilities for fleet communications at Cam Ranh Bay, was completed on 1 August 1967 with the commissioning of NAVCOMMSTA, Cam Ranh Bay.

(2) Project SEA ANCHOR, initiated in August 1965 to provide complete communications facilities for the growing logistic support role of the Naval Support Activity (NAVSUPACT), Da Nang, was completed in September 1967. Initial operations of the NAVSUPACT were hampered by the limited communications available in the Da Nang area, communications support being provided by station ships, such as the USS BAYFIELD (APA-33), until such time as sufficient facilities were available ashore. CINCPACFLT contingency communications assets and equipment listed in the Advanced Base Functional Component (ABFC) System also were utilized to provide interim communications for NAVSUPACT, Da Nang.

(3) In June 1966, Project STARBOARD TACK was initiated to provide helicopter transportable communications facilities for the NAVSUPACT Da Nang, detachments Phu Bai/Hue and Dong Ha. Delivery of these transportable equipments was completed in July 1966, and they were widely used to meet the needs of changing logistic situations in the I Corps Tactical Zone (CTZ).

(4) The unanticipated responsibilities for logistic support of coastal surveillance and riverine patrol and assault operations brought on additional requirements for communications. The Naval Support Activity, Saigon, detachments supporting these operations initially suffered from a lack of adequate communications facilities. As an interim measure, communications equipment listed in the ABFC System and other Navy contingency communications equipment was utilized to fill this need. In January 1966, Project SEARCHLIGHT was initiated to provide semi-permanent communications facilities for the bases and the forces at these bases. The project encountered various delays and was not completed until May 1969.

f. Command Relationships. Lack of a single directive authority for communications in Vietnam resulted in significant problems in its management, control, and operation throughout 1965. During this period, the responsibility for various portions of the system rested with the U.S. Army Support Command, Vietnam (USASCV); STRATCOM-PAC; Defense Communications Agency - Pacific (DCA-PAC); the 1964 Communications Group, U.S. Air Force, under the operational control of the 2d Air Division; and the tactical elements of the Service components. The problems inherent in such fragmentation of authority under the difficult circumstances of the time culminated with the declaration by COMUSMACV in October 1965 that he could no longer tolerate the situation. The problems were resolved when (1) all Army elements were placed under U.S. Army, Vietnam (USARV), and (2) DCA responsibilities were defined and centralized in that Agency's office in Saigon, which in effect was placed under the operational control of MACV.^{46, 47} No action was required in the case of Air Force and other Service components inasmuch as operational control rested within MACV.

5. SUMMARY

a. There were two basic problems in logistics communications to out-of-country points--alternate routing was inadequate and high-quality circuits to Okinawa were unavailable. These problems were not solved until mid-1967.

b. In-country service was unsatisfactory in quantity, quality, and coverage. Plans to upgrade the long-haul systems with fixed-plant facilities were made immediately, but could not

⁴⁶ Command History 1965, op. cit., p. 379-385.

⁴⁷ Ibid., p. 385; Commanders Report, 1 July 1966 - 1 July 1967 (U), op. cit., Highlights, Appendixes 1-3; Col. A. Redman, Centralized Management, Integration, and Operational Direction of Communications System in SEA and Its Impact on the Overall DOD Communications Posture, Student Monograph, Industrial College of the Armed Forces, 1967; MACV/MACTHAI Joint Directive No. 6-66, subject: Southeast Asia Wideband System Management, 28 November 1966.

keep pace with demands, and required an extended period of time before the system could be completed. The problem was further aggravated by the fragmentation of authority over this system, and was not finally solved until 1 April 1966 when all Army communications units came under USARV, and DCA's responsibilities were clearly defined. Interim actions were taken to meet the demands by employing mobile/transportable equipment.⁴⁸ Its flexibility, availability, and performance were among the few plus factors of communications. It must be noted, however, that this equipment was not always available in the quantity desired nor did it meet all requirements for quality and quantity.⁴⁹

c. Of all the communications means employed in Vietnam, probably none created greater frustration to commanders, staffs, and communicators than telephone service. Although problem areas had been identified as early as 1964, significant improvements in local service were not apparent until 1967. Although action to correct the deficiencies was as well underway with the construction of fixed-plant DCOs and tandem switches, long-distance service was still unsatisfactory in January 1969.⁵⁰

d. The digital data communication system consisted largely of aircraft courier flights as late as 1967.⁵¹ Although electrical circuits were in existence, their poor quality introduced an unacceptably high error rate into logistic transactions. Upgrading in-country circuits, construction of new switching facilities, rerouting of out-of-country circuits, and the procurement of improved terminal equipment ultimately produced a satisfactory high-speed, fixed-plant data communications system capable of automatic transmission and routing of narrative as well as logistic traffic throughout the completed portions of the worldwide AUTODIN system. The need for a ship-to-shore system to transmit large volumes of logistics data in a timely manner has not been satisfied.

e. The high volume of narrative message traffic placed an overwhelming burden on the torn tape switching system in Vietnam. A shortage of circuits and channels was compounded by a lack of switching and relay facilities, abuse of the precedence systems, and, in some instances, by unsatisfactory terminal equipment. The major problems were overcome as the IWCS and 439L submarine cable were cut over to service, the torn-tape relay at Phu Lam was expanded and others were constructed at Nha Trang and Da Nang, and the fixed-plant terminal equipment was installed at major commands. Perhaps of greater importance and significance was the transition from teletype operations at speeds of 60-100 words per minute to AUTODIN with high speeds, printout flexibility, and automatic switching with a store and forward capability.

f. The construction of communications facilities by contractors in the combat theater was necessary to fill needs beyond the capabilities of the Services. The efforts were hampered by delays caused by acquisition and construction problems.^{52, 53}

g. With the notable exception of long-distance telephone service which is being improved, the communications system currently is performing satisfactorily. It did not initially, however, meet the requirements of the users in terms of early availability, quality, or quantity desired. The magnitude of the task to be performed, the lack of preliminary planning, the shortages of personnel and equipment, and other inhibiting factors prevented communications from

⁴⁸As late as October 1967 approximately 70% of the DCS circuits in Vietnam were provided by this equipment. (Defense Communications Agency (DCA-313) Memorandum for General Besson, subject: Communications Problems Areas (U), 13 June 1969 (CONFIDENTIAL).

⁴⁹The capability of current and near-future communications to support logistical actions in a contingency situation is a major issue covered in detail in Chapter IV of this monograph.

⁵⁰W. M. Van Haelingen, op. cit., p. 15.

⁵¹Force CEO Memorandum CEO/10CL to Force Supply Officer, subject: GAO Updated: Submission of: and Miscellaneous FLC Position Papers, 6 March 1967.

⁵²The replacement of mobile/transportable communications with high-capacity, high-quality equipment is a major problem area developed in Chapter V of this monograph.

⁵³The detailed development of the overall problems encountered in the construction and procurement areas are covered in those monographs.

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developing as rapidly as the troop and logistics buildup occurred. However, the volume of traffic of all types within the theater and out-of-country had not been predicted. As a result, assessments of communications requirements presented in 1964, prior to major force commitments, were proved valueless by events.

CHAPTER III

LOGISTIC COMMUNICATIONS REQUIREMENTS AND PLANNING

1. INTRODUCTION. During the Vietnam conflict the requirements for communications to support logistic operations have proven to be many and varied. Some logistic communications requirements, such as for underway replenishment and over the beach support in amphibious operations, were established in Service doctrine. For the most part, however, specific requirements were unanticipated in planning for logistic support of the force buildup in Vietnam and were largely dictated by circumstances at the time. This chapter explores the major issues of the identification of logistical communications requirements.

2. BACKGROUND

a. As discussed in Chapter II, the basic method projected in contingency plans to satisfy logistic requirements for communications in RVN was by common-user systems. By this method the needs of the logistic user were to be satisfied together with the needs of administrative and other users. Implementation was not always satisfactory.

b. Because the common-user system was less than satisfactory, a series of communications networks (voice, teletype, and data) evolved in RVN whose purposes were to provide adequate communications between logistic communities of interests. These supplemented the service provided by the common-user systems. As of December 1968, the following circuit utilization in the RVN theater communications system (Table 1) was being made.¹

TABLE 1
DCS CIRCUIT UTILIZATION IN RVN, DECEMBER 1968

<u>Purpose</u>	<u>No. Circuits</u>
Command Control	767
Logistics (including Transportation)	235
Intelligence	171
Aircraft Movement and Control	165
Communications Support and Control	161
Other	154
Civil Agencies	29
Weather	25
Department of State	<u>12</u>
Total DCS Dedicated Circuits	1,719
DCS Common-User Circuits	<u>1,439</u>
Total DCS Circuits	3,158

¹USARPAC, Communications Evaluation in Southeast Asia(U), 30 June 1969, pp. D-142 to D-155 (CONFIDENTIAL).

This table shows that the logistics community was the second largest user of dedicated circuits in RVN in 1968 and that dedicated circuits comprised 55 percent of all DCS circuits.

c. Because dedicated circuits to fulfill logistics requirements in the event of unsatisfactory performance of the common-user system had not been previously identified, there was a delay in their planning and establishment. In addition, the intense effort applied to increasing the effectiveness of the theater common-user networks caused personnel to consider initiation of special purpose networks as a diversion of already limited resources, whose effect would be a further degradation of the common-user network.

d. Recognizing that this common-user philosophy is still reflected in current doctrine, it appears that the provision for specific communications for logistical purposes merits special attention and should be identified justified, and accepted prior to initiation of actual operations.²

3. **IDENTIFICATION.** Identification of logistical requirements for supporting communications services can be made at several levels.

a. The primary level at which specific needs are identified is that of the doctrinal study. This takes various forms among the Services but finds itself expressed in service manuals. As these manuals, e. g., FM 24-1, Tactical Communications Doctrine, are the documentation of the agreed-on principles by which forces are equipped and trained, this is the preferred level at which recognition of specific logistical communications requirements should be found. Achieving recognition at this level is a time-consuming process and requires early initiation.³

b. The second level at which specific needs can be identified is that of contingency planning. At this level, detailed plans can be prepared, generally in an unhurried manner, for the use of the resources allocated for a specific mission. Although the operation, if executed, may vary significantly from that visualized in the contingency plan, the basic methods established in the plan will normally be used as guidance in the execution of the operation, particularly in the early stages of implementation.

c. The third level at which specific needs can be identified is during execution of the actual operation. It is at this time that, although the identification of the need has become most acute to the logistician, the probability of fulfillment is least. To provide for a previously unrecognized need implies taking resources previously allocated to other users. From a practical sense, this becomes very difficult, as time is limited, and the diversion will be a contested point. Generally, activities whose requirements have not been forecasted prior to the operation must continue without fulfillment.

d. The earlier that the specific requirements for supporting communications are identified, the higher is the probability that the resources will be allocated to fill the need.

4. **REQUIREMENTS EXPRESSION.** To express his requirements, the logistician needs to identify the key points in his logistical networks and the information required to pass between them. Specific information that should be provided include:⁴

- a. With whom (what location) each key point must communicate.
- b. Duration of voice calls or length of record message.
- c. Frequency with which each individual key point must communicate with each other key point, and the speed of service required (i. e., acceptable call setup or message delay times).

²The capability of the Services to provide communications for supporting logistic operations during contingency operations using common-user systems is discussed as a major issue in Chapter IV.

³For example, U. S. Army Combat Development Command Letter, Subject: Combat Development Study Directive: Theater Army Communications System Requirement, 1965-1970 (TACS-70) (U), 16 February 1965, originated the subject study. This study was approved by DA letter, same subject, 16 June 1968. Thus 3 years elapsed from the origination of the study until departmental approval.

⁴A more detailed explanation of communications requirements information is provided as Part of Annex B, DOD Instruction 4630.1, 24 April 1968.

- d. Quality of service (e. g. , error rate).
- e. Mode: voice, narrative, or data.
- f. Security requirements.
- g. Justification, including a statement of impact if the required service is not provided.

5. JUSTIFICATION. Several methods, which can be used during doctrinal and force planning, are used to justify communications services.

a. One method is based on needs experienced in similar situations.

b. A second method is that of cost-benefit analysis.⁵ This method expresses the benefits to be gained if the proposed requirement is accepted; it normally involves an analysis of the total logistic system and shows, for example, that:

(1) The benefits that are gained by reduction in total logistic cycle response time are more important than the costs required to decrease this cycle time. The benefits can be expressed in financial terms such as a quantitative reduction in inventory cost.

(2) The components of the logistic system cycle time (e. g. , how much time is to be used for information transfer) have been allocated among the various logistic elements in an optimum manner.⁶

c. The most common method of justification is that of operational necessity; however, the use of this method for logistical nets is not always appropriate.

d. A fourth method of justification is volume of traffic. Direct communications between two elements should be authorized if the volume of traffic between two points requires more than a fixed percentage of the total circuit time.

6. COMMUNICATIONS STANDARDS. It is not reasonable to expect that an extensive justification with supporting analysis will be provided by the logistic user for every circuit requested, nor is it reasonable to expect that every request for communications will be automatically approved. It does seem reasonable, however, to have a set of standards against which requests for supporting communications can be judged.⁷ These standards can take many forms, e. g. , a fixed allocation of telephone lines to each size unit, to include a fixed percentage of each that can be connected into long-distance trunks, a defined criterion for service--busy hour refusal rate of long-distance trunks. Delineation of standards is a detailed total systems engineering task involving the technical identification of criteria against which service is to be furnished, and an assessment of the capability of present equipment to furnish such service. A further iteration may be expected when it is recognized that the economic justification for the amount (and type)

⁵Current literature on this includes DOD Instruction 7141.3 subject: Economic Analysis of Proposed Department of Defense Investments, 29 February 1969; DOD Instruction 7040.5, subject: Definitions of Expenses and Investment costs, September 1966, amended.

⁶An equilibrium point in system design should have been reached where the amount of money spent on any one element of the logistical system to reduce the total cycle time is equal to the amount of money required to be spent on any other element to perform an equal reduction. If this equilibrium point is not reached, funds expended on implementing the logistical system might have been better utilized to reach that cycle time point. For example, it might not be prudent to expend large amounts of money to reduce transit time from 1-day courier service to 1-hour data transmission by electrical means if the average processing cycle of the next processing activity is 7 days.

⁷A similar set of standards exist in construction. For example, for a given number of personnel of certain grades a fixed amount of office space, in terms of square feet, is authorized. These standards, as modified by theater directives, are the basis on which the reasonableness of requests for construction services can be judged.

of equipment required to provide the desired high standards of service is not acceptable at those levels where funds are provided. Recognizing the depth of technical effort involved, an initial "cut and try" series of interim standards may be required pending detailed derivation of a more precisely derived set.⁸

a. General. To provide a set of communications standards for voice systems, three items are required: a priority-oriented list of subscribers, specific grades of service, and the associated cost.⁹

(1) The priority-oriented list of subscribers is a list of all subscribers, identified by position, together with the precedence associated with that line.^{10, 11}

(2) The grade of service describes the number of times a caller, during the busy hour,¹² will not have his call completed due to an "All Trunks Busy" situation.¹³ Thus, a grade of P001 means that during the busy hour, 1 out of every 1,000 calls would receive an All Trunks Busy signal. A grade of P08 would imply that 8 of each 100 calls could not be completed.

(3) The associated task of identifying the cost is relatively easy; models are available that can produce these figures.

b. Planning and Implementation. Given this information, it is possible to make rational decisions on what overall grades of service can be provided.¹⁴ The following is a possible example of a theater common-user voice-switching communications system providing service to logistical and other users. This example illustrates the effect of the cost impact associated with providing specific levels of service.

(1) During basic force planning for a voice switching system to satisfy 100,000 customers, Table 2 was presented showing various grades of service that could be provided at a specific cost.^{15, 16}

⁸See, for example, Appendix B for use of interim standards in RVN.

⁹A set of data systems can be generated in a similar manner, e. g., by restricting release authority on high-precedence messages.

¹⁰Each line has a precedence associated with it. A call involving the use of a higher precedence can be made only after the caller has been identified to the chief operator. Thus, although a Flash Override call could be placed on a line authorized only a Priority call, followup action would be initiated after the fact to ensure that this is the correct usage. It must be emphasized that this followup action is a command function and must be performed through command channels. The communicator cannot act as a policeman in this regard, as a determination concerning the correctness of precedence can be made only by the commanders concerned.

¹¹Associated with the precedence is the holding time; i. e., how long the subscriber's conversation can be. The Bell System provides an incentive to limit a call to 3 minutes by increasing the cost for conversations that extend beyond that time. Recognizing that 3 minutes appears to be sufficient to verbally transmit a message, at the end of 3 minutes a warning could be provided. One minute later the connection could be terminated for all except Flash or Flash Override precedence callers. The establishment of this holding time policy is a function of command. If such a policy is not established, however, a lower grade of service will result for the other subscribers.

¹²The busy hour concept has been used as this directly relates to the Bell System practice. This is an explicit assumption that should be identified as such. At certain echelons (e. g., an Infantry Battalion) this busy hour concept will not be valid as the calling rate is a function of the Battalion's activity. At a logistical unit's headquarters (e. g., a Logistical Command) it appears more valid.

¹³The concept here is, unfortunately, a direct control of demand. The Bell System has indirect control of demand by having lower prices for long distance calls placed after six p. m. This concept, direct cost to the subscriber indirectly affecting demand, is not applicable to the military situation.

¹⁴Providing an additional telephone does not provide additional service, if the associated facilities, switchboards, and trunks are saturated. It merely results in another unhappy subscriber. In addition, it incrementally degrades the service provided to the other subscribers.

¹⁵Basic force planning takes place at military departmental level.

¹⁶These figures are hypothetical.

TABLE 2
PROVISION OF TELEPHONE SERVICE (INITIAL TRIAL)

<u>Authorized Precedence</u>	<u>Subscriber Numbers</u>	<u>Grade of Service</u>	<u>Total Cost</u>
Flash Override	1-30	P001	\$4 Billion
Flash	31-330	P01	
Immediate	331-2,330	P05	
Priority	2,331-20,330	P25	
Routine	20,331-100,000	P95	

Table 2 shows that 30 subscribers are provided with Flash Override priority and 1 out of every 1,000 calls will not be completed for those callers. In similar fashion, 100 callers are authorized to make Flash calls, and 1 out of every 100 calls will not be completed. The total cost of the system is \$4 billion.

(2) At the initial review, although the overall service is acceptable, the cost is considered too high. Direction is given to consider a lower cost figure.

(3) Table 3 is derived by incorporating a lower cost figure that provides a lower grade of service at less cost.

TABLE 3
PROVISION OF TELEPHONE SERVICE (SECOND TRIAL)

<u>Authorized Precedence</u>	<u>Subscriber Numbers</u>	<u>Grade of Service</u>	<u>Total Cost</u>
Flash Override	1-25	P001	\$500 million
Flash	26-125	P01	
Immediate	126-1,625	P10	
Priority	1,626-16,625	P45	
Routine	16,626-100,000	P98	

After review of Table 3, the cost figure is acceptable, but the subscriber list is to be analyzed in detail.

(4) After discussion and consideration of all operational, logistical, and administrative requirements, it is decided that within the constraints of the \$500 million a better grade of service for Immediate precedence users is desired. The service shown in Table 4 is to be provided by deleting subscribers from the "immediate precedence" category.

TABLE 4
PROVISION OF TELEPHONE SERVICE (FINAL)

<u>Authorized Precedence</u>	<u>Subscriber Numbers</u>	<u>Grade of Service</u>	<u>Total Cost</u>
Flash Override	1-25	P001	\$500 million
Flash	26-125	P01	
Immediate	126-1, 125	P03	
Priority	1, 126-16, 625	P45	
Routine	16, 626-100, 000	P98	

Based on this decision, a specific communications capability is provided as part of the total force structure.

(5) At a later date, during planning for a contingency operation, the limitations of the user Immediate precedence is removed.¹⁷ One month later, during execution of the operation, Table 5 is compiled.

TABLE 5
PROVISION OF TELEPHONE SERVICE (ACTUAL)

<u>Authorized Precedence</u>	<u>Subscriber Numbers</u>	<u>Grade of Service</u>
Flash Override	1-25	P001
Flash	26-125	P01
Immediate	126-100, 000	P96

Table 5 shows that 99,875 subscribers, all of whom use Immediate are unable to complete 96 out of each 100 calls attempted. Shortly thereafter, precedence authorization is placed into effect and the situation reverts to that previously shown in Table 4.

7. **EXPERIENCE.** When all the paper analyses and justifications have been tabulated, discussed, and debated there will still exist reasonable doubt concerning the ability of the logistics systems to operate over the specified communications systems. Recognizing that specific needs of logistic elements will evolve only after extensive field experience, this experience should be obtained whenever possible.

¹⁷The priority-oriented list of subscribers is not fixed. It can, should, and probably would be modified in the field by the commander concerned. However, the impact of these changes may be to provide an overall degradation of service to other subscribers. Although the physical limitations of a truck company are understood (i.e., only so much cargo can be hauled) a similar understanding of communications units is not common. Given a certain size switchboard with supporting long distance trunks, however, only a fixed number of subscribers can be efficiently served.

a. The preferred method from which to obtain near-actual data on logistics communications flow--messages and telephone calls--would be long-duration exercises during which initial stocks are drawn down and substantial replenishment action is required. However, there are severe problems with exercises.

(1) Because of funding and other limitations, the duration of these exercises is normally not sufficiently long enough to enable significant data to be gathered or to generate realistic requirements for the logistician or the communicator.

(2) The environment in which these exercises are held may be artificial; e.g., all equipment is working and complete basic loads of spares are available. These units are peaked up for the exercise. Thus, the data do not always reflect what might have occurred under real conditions.

b. The real time play of communications and its associated problems during logistics exercises, such as the Army's LOGX, might also yield significant results. For example, the problems of personnel in a movement control center attempting to contact a port facility through a chain of three to four overloaded tactical switchboards might highlight some of the real-world problems and their associated impacts, and lead to appropriate solutions. However, the inclusion of real-world factors into these logistical exercises would cause these exercises to be too long. Present time constraints on these actions thus preclude the real time play of communications.

c. From the above, it can be seen that the real-world constraints on present exercises preclude significant communications data from being obtained. Current efforts by logisticians to overcome the limitations of limited-duration exercises include extensive use of gaming and computer simulation. It thus appears that these logistic gaming and simulation models should be modified and expanded to include the real-world effects of communications.

8. CONCLUSIONS AND RECOMMENDATIONS

a. Conclusions. By December 1968, more than 14 percent of the dedicated circuits in the Republic of Vietnam theater communications system were used for logistic traffic. The majority of these requirements had not been previously identified in doctrine or during preparation of contingency plans. This Board has been unable to find any evidence that this experience involving the use of dedicated circuits has led to identification and validation of overall specific logistical requirements for communications services nor has it been reflected in overall doctrine or planning¹⁸ (paragraph 2).

(1) Identification of logistical requirements for communications should be made at the doctrinal level and in contingency plans. Results of this identification process should reflect the experience gained from actual operations, exercises, and computer simulation and war gaming (paragraphs 2, 3, 7).

(2) Justification of these logistic communications needs is required. This is currently hampered by a lack of standards against which requests for service can be measured (paragraphs 5, 6).

b. Recommendations. The Board recommends that:

(1) The Joint Chiefs of Staff instructions for contingency planning give specific reference to the identification of logistic requirements for communications and the means of gaining access to the Automatic Digital Network system (CM-1) (conclusion (1)).

¹⁸See Chapter IV of this monograph.

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(2) The Services include the identification, quantification, and justification of specific logistic requirements for communications as part of their basic doctrinal reviews and studies, e.g., the Army--80 series of studies (CM-2) (conclusions (1) and (2)).

(3) The Services develop planning factors for communications services against which requests for logistic and other communications services can be measured. These planning factors should include but not be limited to a priority-oriented list of subscribers, grades of service, and cost (CM-3) (conclusion (2)).

(4) The Joint Chiefs of Staff and service logistical gaming and computer simulations include realistic communications effects to the maximum extent possible. As practicable, specific logistical requirements for communications resulting from such simulation should be provided for contingency and doctrinal planning purposes (CM-4) (conclusion (1)).

CHAPTER IV

READINESS FOR CONTINGENCIES

1. **INTRODUCTION.** The long delay in satisfying communications requirements in Vietnam indicated that there were some serious shortcomings in planning for deployment to that theater. Such shortcomings might well be problem areas for future contingency operations planning. In this chapter an examination is made of the readiness of communications to meet requirements for logistic operations in contingency situations.

2. **BACKGROUND.** As seen by the communications buildup in Vietnam, there were substantial requirements by logistical elements for communications support.^{1,2} These requirements included both voice and record communications with heavy emphasis on digital data transmission. These requirements were satisfied with varying degrees of success by common-user systems and consequently were supplemented by dedicated circuits. However, in review of current doctrine and contingency plans, it has been noted that there are few specific allowances of communications support made directly for logistics, and the Services are still placing major reliance on common-user systems to meet their logistic communications needs.

a. Current Army field manuals³ emphasize that in the theater-of-operations, the Army area communications system will provide communications for combat service support units, and that these will be common-user facilities.⁴ Circuits interconnecting computers are recognized as requiring either common-user or sole-user channels.⁵

b. Naval Communications Stations are the standard points where message traffic is transferred between Navy operational circuits and Defense Communications Systems circuits. Some Navy circuits are specifically set aside for logistical traffic, e.g., for underway replenishment and amphibious operations.^{6,7} However, Vietnam experience proved the need for additional dedicated circuitry to support logistic operations in-country.

c. Marine Corps doctrine does not identify any specific requirements for logistical communications external to the landing forces.⁸ However, within the landing force some logistic circuits are identified, e.g., shore party command net.

¹ See Chapter II and Appendixes A through E of this monograph.

² See Chapter III of this monograph for circuits dedicated to logistics.

³ These include Department of the Army, FM 11-23, U. S. Army Strategic Communications Command (Theater), October 1967; FM 11-62, Combat Area Signal Battalion, Army, December 1968; FM 24-1, Tactical Communications Doctrine, April 1968; FM 54-3, The Field Army Support Command, June 1965; FM 54-7, The Theater Army Support Command, September 1968; FM 54-8, The Administration Support Theater Army TASTA-70 (TEST), March 1967.

⁴ See, for example, FM 24-1, Tactical Communications Doctrine, April 1968, p. 13.

⁵ Ibid., p. 14.

⁶ Department of the Navy, DNC 5(B), U. S. Naval Communications Instructions and Procedures (U), March 1968, pp. 1-7 (CONFIDENTIAL).

⁷ Department of the Navy, NWP 16(B), Basic Operational Communications Doctrine (U), 21 October 1965 (as amended up to 21 May 1969), p. A-22 (CONFIDENTIAL).

⁸ Ibid.; Department of the Navy NWP 22(B), Doctrine for Amphibious Operations (U), (CONFIDENTIAL); Marine Corps, FMFM 10-1, Communications, 27 January 1965.

d. The mobility concepts of the Air Force, including provisions of support communications, do not make any specific allowance for logistic communications. However, conceptual logistic support of deployed units includes access to a supporting computer.⁹

e. Thus, although the requirements of logistics or communications must be satisfied, the specific identification of these requirements has not been made in most cases.¹⁰ Accordingly, only the capability of communications to provide high-quality, common-user voice, and message-switching (including data) has been examined.

3. **COMMUNICATIONS SYSTEMS.** There are two communications systems that provide support to logistical elements in any theater-of-operations. These are the Defense Communications System (DCS) and the tactical communications systems that support tactical units.

a. The DCS is the single worldwide complex comprising all long-haul, point-to-point communications facilities, personnel and material within the Department of Defense (DOD)—with certain specific exceptions.¹¹ The DCS is composed of transmission subsystems, switched networks, and certain dedicated networks. The transmission media used include cable, point-to-point radio (microwave, tropospheric scatter, and high frequency), and satellite.¹² It is essentially composed of fixed-plant facilities owned and operated by the individual Services under the management direction of the Defense Communications Agency (DCA).¹³ Some of these links are provided through lease arrangement with commercial carriers. This melding of service-owned and leased facilities has resulted for the most part in high-quality communications links¹⁴ trunking the CONUS and certain overseas areas, the major portions of which are shown in Figures 5 and 6.¹⁵

b. Tactical communications consisting primarily of mobile/transportable equipment provide the second major resource and are designed for use within a theater-of-operations. These mobile/transportable elements are required to provide communications to support the employment of tactical forces. This equipment is not designed to provide high-capacity, high-quality communications comparable to that provided by fixed-plant facilities, but is designed to support voice and teletype operations in a tactical situation.¹⁶ Tactical equipment includes mobile/transportable radio sets (microwave, tropospheric scatter, and high frequency) field wire, cable, manual telephone switchboards,¹⁷ message centers, and limited technical control facilities.¹⁸

⁹ Air Force Manual 2-7, Tactical Air Force Operations—Tactical Air Control System (TACS), 5 June 1967; Air Force Manual 100-37, Tactical Communications Electronics Planning, 15 November 1965; USAF Mobility Plan (U), 1 January 1969, Appendix 4 to Annex D (CONFIDENTIAL).

¹⁰ The problems surrounding the detailed definition and validation of specific logistic requirements for communications services beyond those provided by common-user systems are discussed in detail in Chapter III of this monograph.

¹¹ Department of Defense Directive 5105.19, The Defense Communications Agency, 15 September 1967.

¹² Defense Communications Agency, The Present DCS (U), Volume II, The Defense Communications System Plan 1971-1981 (U), October 1968, p. 11 (SECRET).

¹³ Department of Defense Directive 5105.19, The Defense Communications Agency, 15 September 1967.

¹⁴ Not all of the DCS links are of the desired quality; these have been identified. See Defense Communications Agency, The Present DCS (U), Volume II, The Defense Communications System Plan 1971-1981 (U), October 1968, p. 50 (SECRET).

¹⁵ For a complete description of the DCS see Defense Communications Agency, The Present DCS (U), Volume II, The Defense Communications System Plan 1971-1981 (U), October 1968 (SECRET).

¹⁶ These voice channels can be used to pass data under appropriate conditions. However, tactical communications equipment was not designed with data transmission characteristics as a primary goal.

¹⁷ There are limited quantities of automatic telephone switchboards such as the AN/TTC-25, 28, and 30a.

¹⁸ Various items of fixed-plant communications equipment, including IBM 360/20 computer terminals, have been mounted in vans to provide a specific capability not existing in tactical equipment. These are limited in terms of mobility and ability to exist in the environment found in lower tactical echelons. In turn, these must use, with varying degrees of success, the rest of the tactical communications system.

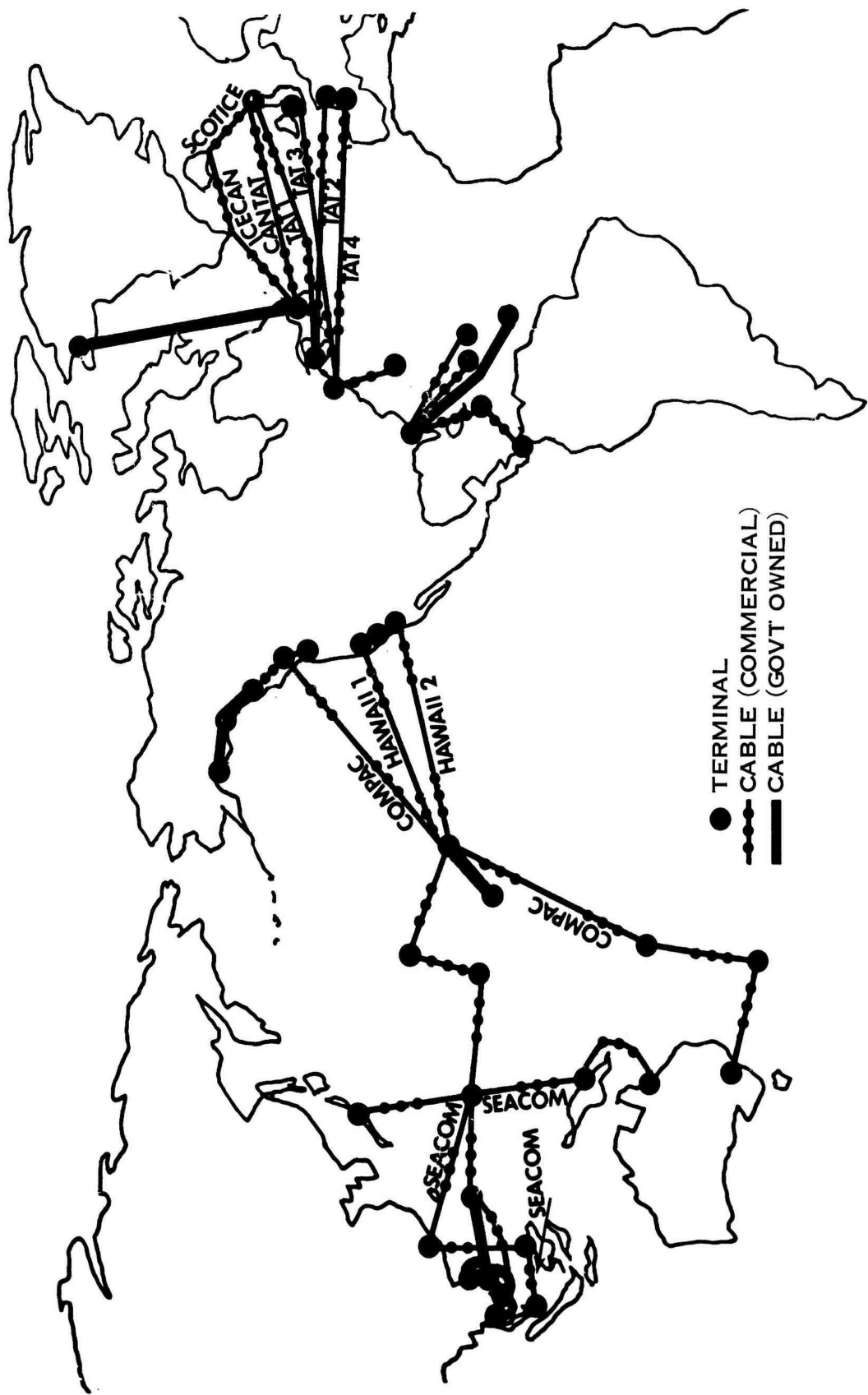


FIGURE 5. SUBMARINE CABLE ROUTES

Source: DCA Report, DCS Resources Inventory and Allocation, July 1969, Chart 25.

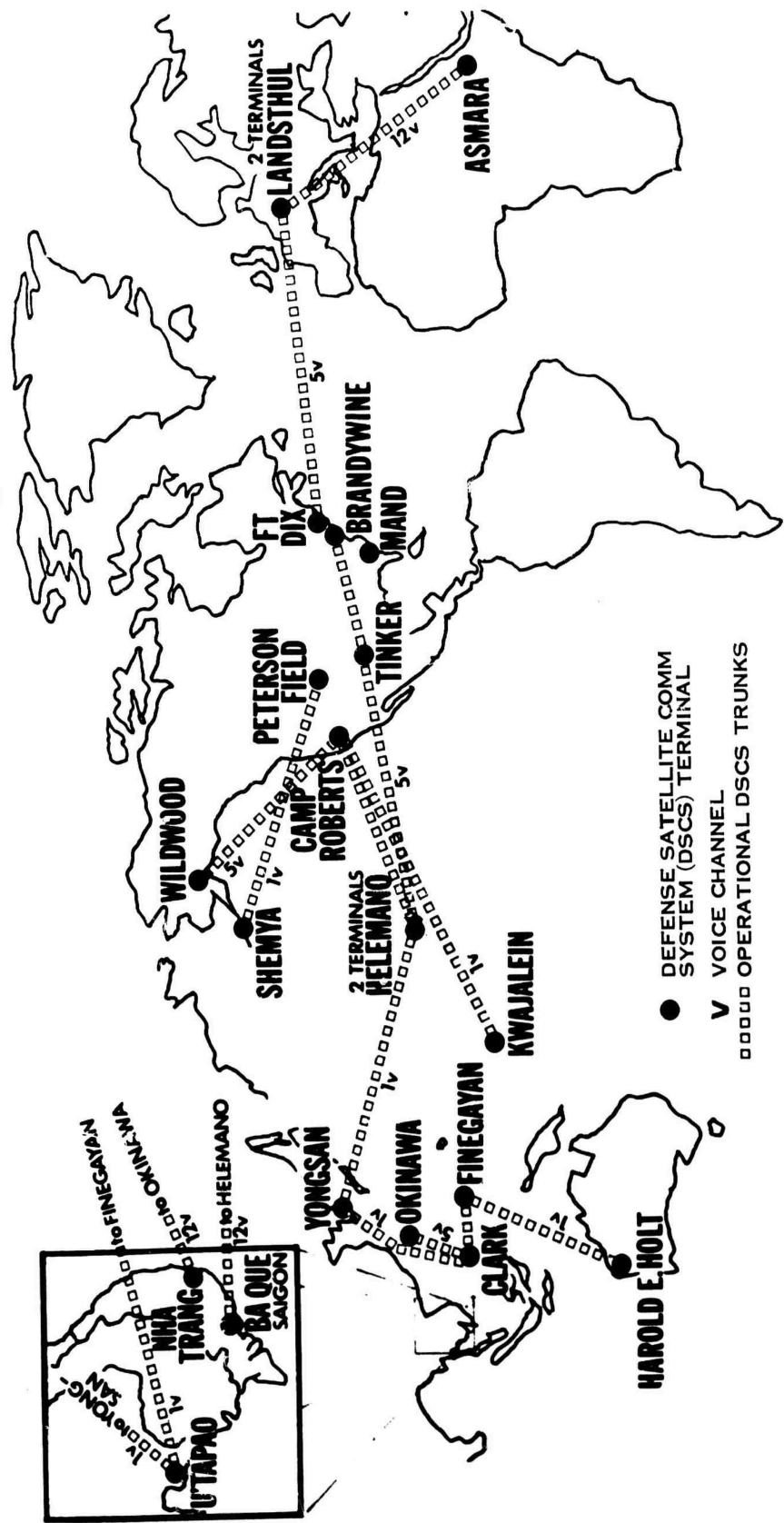


FIGURE 6. DCS SATELLITE COMMUNICATIONS

Source: DCA Report, DCS Resources Inventory and Allocation, July 1969, Chart 26.

4. **COMMUNICATIONS NETWORKS.** There are two common-user switched networks provided as part of the DCS that are of prime importance to logistical elements—the Automatic Digital Network (AUTODIN) and the Automatic Voice Network (AUTOVON).

a. **AUTODIN.** AUTODIN is a high-speed, secure data, and teletypewriter message switching subsystem. It consists of Automatic Switching Centers (ASCs) and a variety of subscriber terminals to meet specific requirements in such forms as page copy, punched machine cards, and magnetic tape. AUTODIN provides a high order of accuracy through an automatic error detection and retransmission capability. There are 8 operational ASCs within the CONUS and 12 overseas.¹⁹ (See Figure 7 and Table 6 for the geographical location and tributary capacity of each switching center.) All of the ASCs are trunked together and are capable of secure information transfer at the rate of at least 2,400 bits per second (approximately 200 cards per minute). AUTODIN is currently operating at substantially less than 50 percent of its capacity.²⁰

b. **AUTOVON.** AUTOVON is an automatic circuit-switched network that provides voice communications. It consists of ASCs that provide rapid switching of voice circuits on a direct basis, with features for data transmission, multilevel preemption, conferencing, operator assistance, and graphic communications.²¹

5. **SIGNIFICANT PROGRAM AREAS.** The Defense Communications System (DCS) provides communications between theaters-of-operation and CONUS or other overseas bases. Once logistic traffic reaches the fixed-plant portion of the DCS, rapid delivery to the addressees is reasonably assured. There are, however, some areas of concern that are discussed briefly below.

a. **Critical Geographical Areas.** The capability of extending circuits to a new theater-of-operations, particularly to those users who rely heavily on data traffic, is extremely limited. From an examination of the location of current DCS stations and capabilities, it appears that the major geographical areas that are devoid of nodes to which communications could be readily extended in a contingency situation are the Indian subcontinent, the Middle East, Africa south of the Sahara, and South America.^{22, 23}

b. **Current Extension Capability.** Examination of the current capability to extend communications to those areas referred to in the preceding paragraph, reveals that there would be a distinct lack of communications during the early stages of a deployment.

(1) Equipment used to provide communications would be of the same basic type employed in the Vietnam theater with varying degrees of success. Extension of communications to the theater-of-operations would be by high-frequency (HF) single sideband and tropospheric scatter radio supplemented by satellite relay. The high-frequency circuits would be provided by mobile/transportable high-frequency radios such as the AN/TSC-38, each of which could support three voice and 16 teletypewriter channels. (A typical contingency communications deployment is shown in Figure 9.) Circuits could also be rapidly extended in approximately 200-mile increments

¹⁹Defense Communications Agency, The Present DCS (U), Volume II, The Defense Communications System Plan 1971-1981 (U), October 1968, p. 22 (SECRET).

²⁰For example, the Nha Trang AUTODIN ASC during January 1969, operated at 20 percent of capacity. (see Nha Trang Signal Battalion, AUTODIN ASC Communications Operations Performance Summary, January 1969.)

²¹Defense Communications Agency, The Present DCS (U), Volume II, The Defense Communications System Plan 1971-1981 (U), October 1968, p. 21 (SECRET).

²²For details of the restoration of the DCS in general war see MJCS 106-69, subject: Plan for Critical DCS Communications Support in General and Limited War (U) (SECRET).

²³There is in existence a worldwide commercial satellite network, a projection of which is shown in Figure 8. Because each of these terminals is owned and operated by a member nation of the International Telecommunications Satellite Consortium (INTELSAT), access is subject to negotiation with member nations by an international carrier at the time communications channels are required. Commercial satellites offer high-quality, high-capacity communications channels.

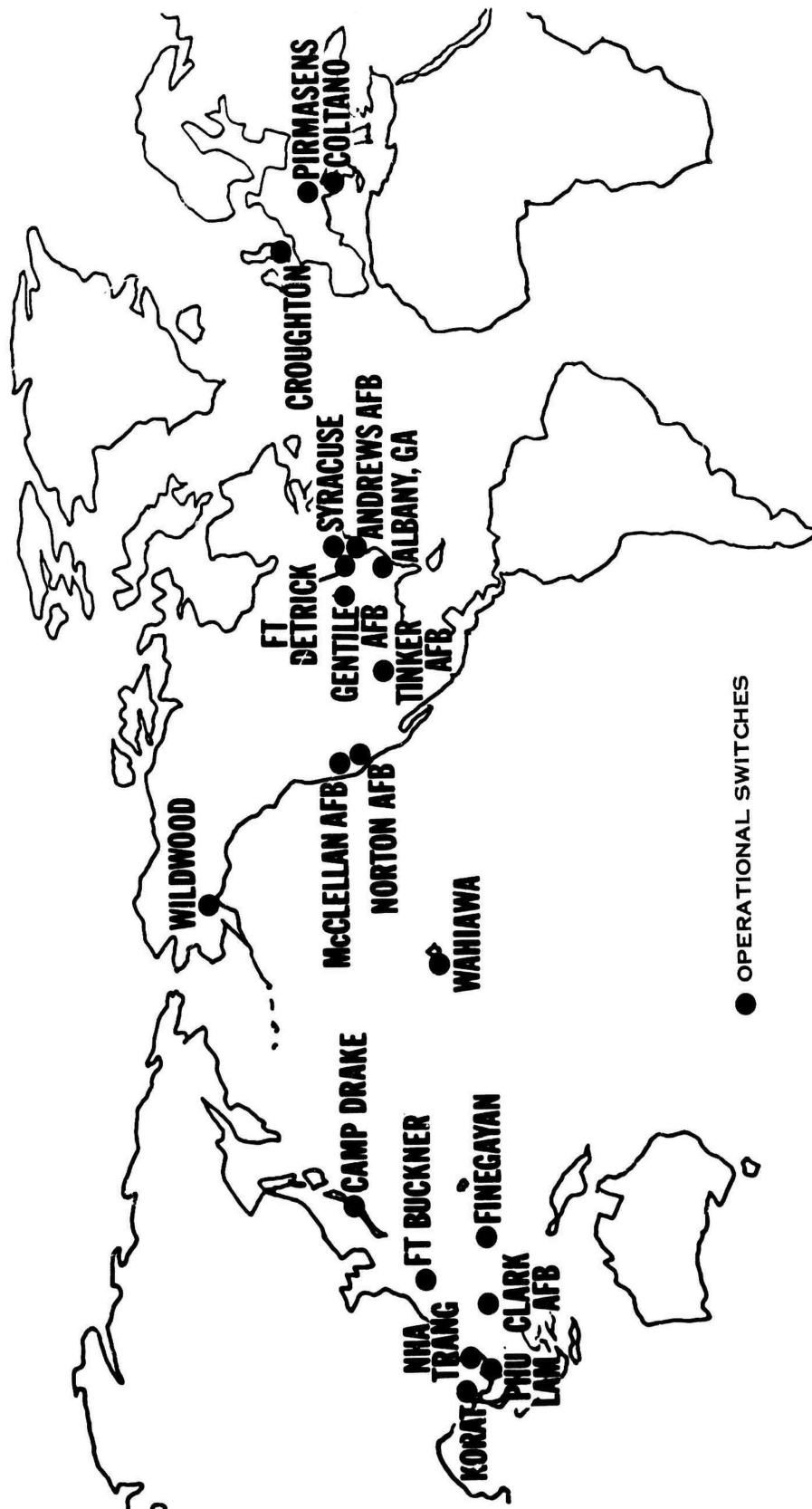


FIGURE 7. AUTODIN SWITCHES

Source: DCA Report, DCS Resources Inventory and Allocation, July 1969, Chart 27.

TABLE 6

AUTOMATIC SWITCHING CENTER CHANNEL CAPACITIES

<u>Switch</u>	<u>Channel Capacity</u>
Syracuse, New York*	300
Fort Detrick, Maryland*	300
Andrews AFB, Maryland*	300
Albany, Georgia*	300
Gentile, Ohio*	300
Tinker AFB, Oklahoma*	300
Norton AFB, Calif.*	300
McClellan AFB, Calif.*	300
Wahiawa, Hawaii*	300
Wildwood AFB, Alaska	200
Finegayan N. S. , Guam	100
Camp Drake, Japan	200
Fort Buckner, Okinawa	100
Clark AFB, Philippines	100
Korat, Thailand	100
Phu Lam, Vietnam	100
Nha Trang, Vietnam	100
Croughton, England	150
Pirmasens, Germany	200
Coltano, Italy	200

*Leased Switches (Western Union)

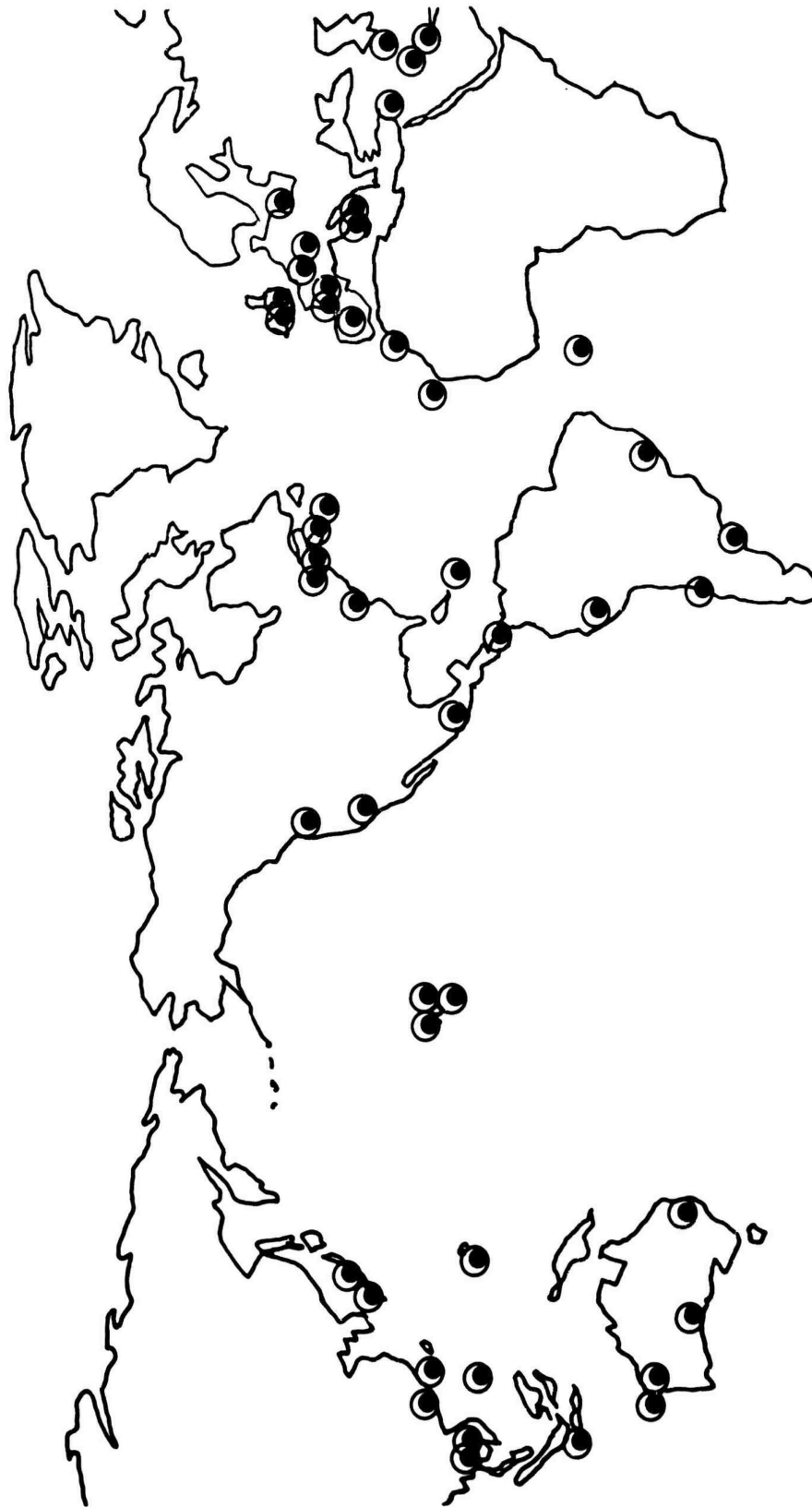


FIGURE 8. INTERNATIONAL TELECOMMUNICATIONS SATELLITE CONSORTIUM
 TERMINAL LOCATIONS PROJECTED TO BE OPERATIONAL AT
 END OF DECEMBER 1969

Source: COMSAT Corporation.

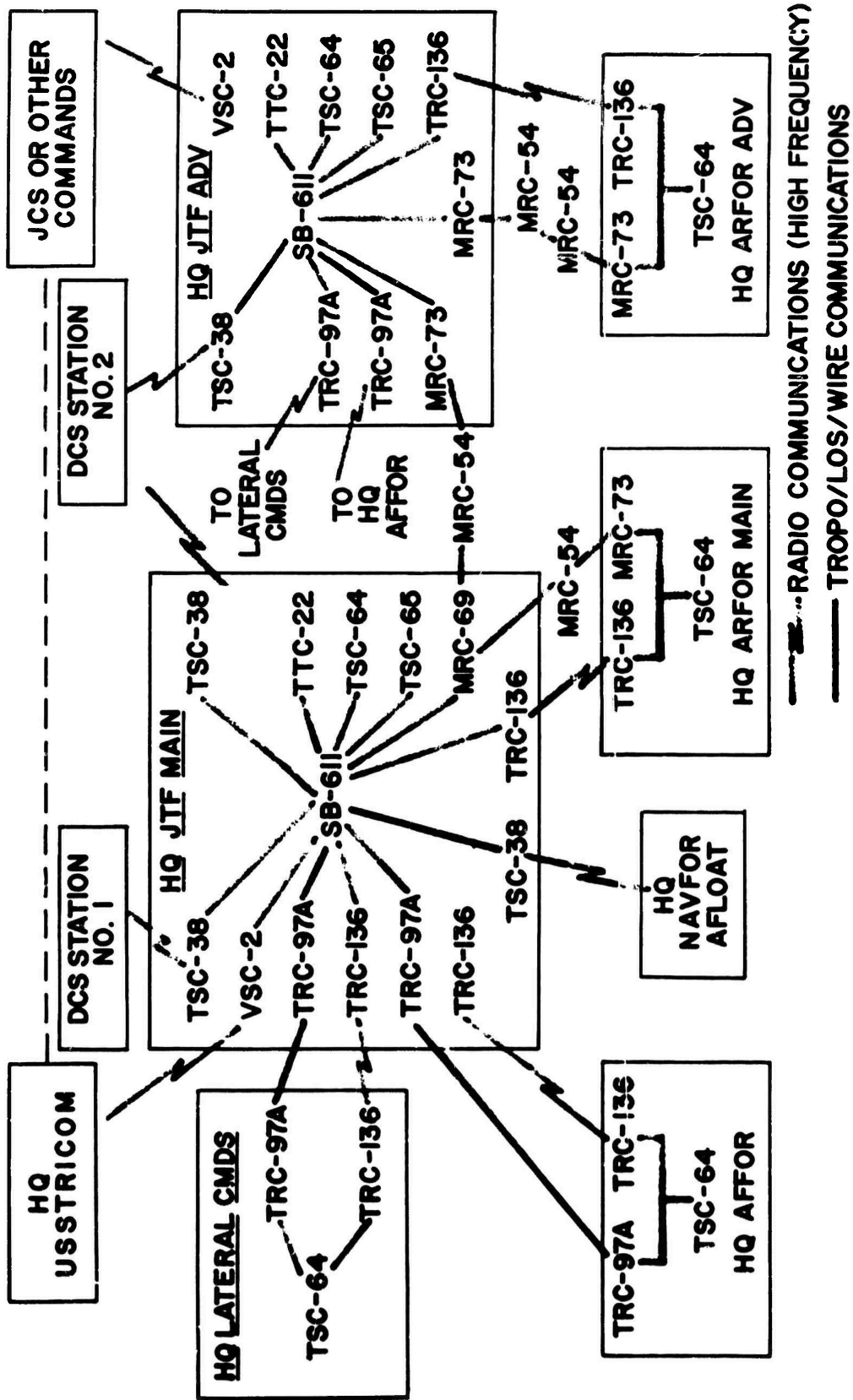


FIGURE 9. TYPE CONTINGENCY COMMUNICATIONS

Source: U.S. STRIKE Command.

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by using available tropo assets that would satisfy the wideband data link requirements for logistics. Real estate would have to be under friendly control to use this method of extension. Mobile Satellite Terminals, AN/TSC-54s,²⁴ would also be deployed to extend circuits to a theater-of-operations. Each of the AN/TSC-54 terminals currently provides one voice and one teletype channel. More of these equipments can be deployed; however, recognizing the known problems of HF²⁵ and satellite²⁶ links in supporting data traffic as well as the demands of the operational users for circuits,²⁷ it is not expected that a high-speed (200 cards per minute) data circuit will be provided for logistical traffic by these means.^{28, 29} Transportable satellite terminals, AN/MS-46, are also in the inventory and possess a 12-voice channel capacity. However, these are all committed in support of current operational communications.

(2) Recognizing the need for extension of the DCS, some limited communications contingency packages have been assembled. These consist of transportable tropospheric scatter (tropo) and high-frequency radios, manual technical controls, and manual telephone switchboards.

²⁴The service inventory of satellite terminals (AN/TSC-54) is small.

²⁵HF links have proved unreliable for data transmission due to:

- a. The worldwide problems of frequency interference in the HF band.
- b. The short term fade characteristics of the sky-wave propagation.

High-speed data transmission via HF requires special modems and forward error correction equipment. However, this equipment, which enables a HF link to meet the accuracy requirements of DCS AUTODIN, has not been provided because of the additional cost involved.

²⁶Satellite links, although providing high-quality transmission paths, have a significant turn-around time for acknowledgment signals. Existing data transmission schemes for commercial transceivers send a block of data, then wait to receive an acknowledgment signal from the distant end for that block. The sending terminal will not send another block of data until a receipt for the first block has been received. The path length of a satellite circuit causes substantial time delays in the receipt of the acknowledgment signal. The effect of this delay is to cut the effective speed of the channel. (This specifically holds for AUTODIN. Block-by-block transmission is downgraded from 2400 bits/second to 900 bits/second and continuous transmissions are downgraded to 1600 bits/second.) Although this problem has been formally identified at least twice in the last 6 years, this Board has been unable to discover that the problem is being attacked.

- a. This problem was reported during 1964 by the Commander of DCA-PAC in discussing use of the SYCOM Satellite System in support of operations in RVN as follows: "Due to inherent time delay for parity checks maximum data speed (via satellite) is about 50 cards per minute." (Defense Communications Agency Report, Commanders Conference 1964 (U), undated, p. 40 (CONFIDENTIAL)).
- b. A second report on this problem was made by the Chief, DCA-PAC in discussing the actions taken during the 1967 break in the cable connecting Guam with the Philippines as follows: "During the recent (TRANSPAC cable) failure, attempts at restoral (of high band rate AUTODIN circuits) via high-frequency radio were generally unsuccessful and restoral via satellite was at greatly reduced transmission rates." (Presentation by Chief, DCA Pacific to the DCA Commanders Conference, 5 October 1967, p. 7.)

²⁷A complete discussion of all the validated requirements for circuits out of RVN is not provided to preclude classification of this report. However, it is noted that the total high-quality circuit capability out of RVN is 90-voice circuits (60-voice circuits via the WET WASH submarine cable, 24 from the two Defense Communications Satellite System Terminals, and 6 via COMSAT Satellite). All of these are currently in use. As of December 1968, seven of these circuits were for AUTODIN use, (DCA, DCS Communications Handbook, 4th Qtr-FY 69 (U), p. 29) and 23 were for common-user voice service from the Saigon Joint Overseas Switchboard (Phu Lam Signal Battalion, Communications Operations Performance Summary (U), December 1968), leaving 60 circuits to meet sole-user requirements.

²⁸The DCA Plan (see DCS Subsystem Project Plan 7-68, Defense Satellite Communications System Phase II (U), 22 November 1968 (Secret)) for expansion of the Defense Communications Satellite System calls for modification of the AN/TSC-54s to provide a 12-voice channel capacity. Funds to provide this modification have not yet been released.

²⁹The DCA has been directed to prepare a plan for extension or restoration of the DCS as a complete system with the capability of being expanded rapidly. (See MJCS 186-66, subject: Mobile/Transportable Communications Equipment, 18 July 1966, and DCA Plan for Mobile/Transportable Communications Support for Contingency Operations (U), February 1967 (SECRET).)

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Augmentation of these contingency packages is necessary to provide a greater capability for wide-band transmission, technical control, digital message switching, and expanded satellite terminals. Some equipment for this augmentation is commercially available (e.g., AUTODIN terminal equipment using IBM 360/20 or UNIVAC 1004), but it has not been procured, van-mounted, and assigned a contingency role.

(3) Although the major communications relay ships, USS ANNAPOLIS (AGMR-1) and USS ARLINGTON (AGMR-2), used to provide supplemental Naval communications during the early phases of the Vietnam era, have been decommissioned, they are being retained in a readiness status sufficient to permit their deployment, within a short period for extension of the Naval Communications System, where needed.

c. Ship-Shore Data System. The digital data shore communications needs of the Navy are satisfied in large part through the use of AUTODIN. However, there is a continuing, urgent fleet requirement for a reliable long-range ship-to-shore data transmission system, capable of handling large volumes of digital data in a timely manner and interfacing with automated systems ashore. Previous efforts during the Vietnam era to establish a ship-to-shore data system to handle mounting Seventh Fleet logistic traffic loads met with limited success (6-10 cards per minute due to vagaries in the HF transmission media), but demonstrated the utility of an HF data transmission system. The Defense Satellite Communications System (DSCS) and Tactical Satellite Communications programs, with their greatly increased capacity for handling digital data, offer the best solution to the reliable long-range, ship-to-shore link problem. But until such time as shipboard satellite terminals can be installed on a wide basis, an HF digital data system is necessary to meet requirements of automated logistic systems. To this end, a Specific Operational Requirement has been initiated for the engineering development of an HF data transmission system.

d. Theater Communications. The ability of tactical communications systems in a theater-of-operations to support adequately logistical traffic has constraints. These are discussed in the following paragraphs.

(1) Availability of Communications. Communications are expensive. For example, it costs an estimated \$350 million yearly to maintain a communications capability in support of one field army consisting of two corps and eight divisions and one communications zone. The total value of the equipment of this communications complex is approximately \$500 million.³⁰ For a 24-division force, the total investment cost is \$1.5 billion, and the total sustaining cost is \$1.0 billion. The high cost of supporting communications has caused a complete Office of the Secretary of Defense (OSD) review of multichannel communications requirements in a theater-of-operations. (Some of the desired units are already in existence; thus, initial investment costs for those units have already been made. Only the sustaining costs are recurring.) The high cost will discourage approval of funds necessary to complete the early acquisition of the remainder of doctrinally required communications.³¹

(2) Commitment of Resources. As shown from the above, in the event of a major contingency, the total doctrinally required communications capability will not be immediately available. Therefore, the communications resources will be less than those indicated as required. From the above, should a major contingency develop prior to the acquisition of the

³⁰ Department of the Army, Letter CEPP-25, Memorandum for U.S. Army Member, JLRB, subject: Logistical Requirements for Communications Support (U), 3 September 1969 (CONFIDENTIAL).

³¹ Deputy Secretary of Defense Memorandum, subject: Requirements for Multi-Channel Communications for Theaters-of-Operations, 20 August 1969.

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necessary tactical communications equipment, or should the necessary equipment not be procured at any time, the total doctrinally required communications capability will not be immediately available.^{32, 33}

(3) Quality of Communications. The quality of communications to be provided by the tactical common-user systems, even if all the units required by doctrine are available, is limited.

(a) Voice Switching. The current tactical communications systems provide only manual two-wire switching. This will not provide the quality of communications required for long-distance telephone service as demonstrated in SE Asia (see Chapter II and Appendix D). Although the need for automatic switching of telephone lines in a theater-of-operations has been discussed previously, its implementation in the field is at least 5 years away except for expedients like the AN/TTC-28 and AN/TTC-30.³⁴

(b) Message Switching. Teletype service, with torn tape relays, is projected to be available. Mobile Data Terminals and low speed transportable Digital Subscriber Terminal Equipments (DSTEs) are now available in limited quantities. However, a Tactical Automatic Message Switch has not been programmed, funded, or approved for general use.³⁵ The use of Mobile Data Terminals or Transportable Digital Subscriber Terminal Equipment without a Tactical Automatic Switch is most impractical unless each Service is prepared to support many dedicated quality channels as far as the nearest AUTODIN switch.

(c) Circuit Quality. High-quality circuits will not normally be immediately available in a tactical theater-of-operations due to the following:

1. The sites on which terminals are located to support microwave and tropo links are normally chosen for tactical reasons (e.g., security and proximity to a headquarters) and not for high-quality propagation path characteristics.

2. The limited time available in which to establish initial communications links does not permit the extensive line-up and testing procedures required for quality channels.

3. The provision of circuit conditioning equipment to provide quality circuits to subscribers is not consistent with mobility requirements. These items, such as line amplifiers and delay distortion equalizers, occupy substantial space and degrade mobility.

4. The extension of circuits to subscribers under tactical conditions is normally accomplished using field wire WD-1/TT, which precludes initial provision of high-quality circuitry.³⁶

e. Commonality and Compatibility. In order to provide communications support both inside the theater-of-operations and from the theater-of-operations to CONUS, the investment

³²A detailed analysis of specific contingency plans is not provided to preclude classification of this document.

³³Unanticipated logistic communications requirements associated with the buildup of forces in RVN and new and expanding operations in a counterinsurgency environment, quickly depleted available stocks of radio equipment, necessitating commercial procurement and diversion of equipment from ongoing projects elsewhere in order to meet urgent needs.

³⁴The TACOM study, previously referenced, recognized the need for automatic switching. The limited use of AN/TTC-28s in RVN is described in Appendix D. See Air Force 407L program for role of AN/TTC-30.

³⁵One Tactical Automatic Message Switching Unit using van-model components of a digital computer has been fabricated for the Seventh Army.

³⁶Field wire can be laid quickly but the electrical characteristics of this wire, including impedance and line loss, change with the weather. Thus, subscriber sections of these circuits do not have constant line loss or constant distortion. Therefore, compensating adjustments to the line to provide a high-quality circuit cannot be made. (Lead or polyethylene-insulated multipair cable is used after conditions stabilize.)

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cost of existing communications equipment must be recognized. To make maximum use of available funds for new procurement and previous investments in communications equipment requires that commonality and compatibility be achieved in a positive and orderly manner.

(1) There are many different types of communications equipment with only marginal differences in performance and characteristics, all of which serve the same function. For example, at the present time, there are three separate families of 1-kw light tropospheric scatter radio (tropo) terminals, all of which possess the same basic properties and perform the same functions—the AN/TRC-97, (A); the AN/TRC-66, (A); and the AN/TRC-90, (A), (B), -126, -132, families.³⁷ Other 1-kw tropo terminals are also being developed, e.g., AN/TRC-112. A similar situation exists regarding microwave, multiplex, and other C-E equipment. In addition to substantial expenditures of time and money for development, the impact of this proliferation of functionally equivalent but not identical equipment is to provide an additional burden on the logistics systems for support, as well as increasing netting problems when used in joint operations.

(2) The development and standardization of all new communications equipment must be oriented toward making the new equipment compatible with existing equipment still capable of useful performance. The interface problems that existed in Vietnam between communications equipment have been detailed in Appendixes A and C. However, despite this experience, the problem is being perpetuated today.³⁸ The tactical systems under development are not compatible with the existing tactical communications system, or with the DCS.³⁹ For example, the DCS has been standardized on a frequency division multiplex voice carrier, the AN/UUC-4,⁴⁰ whereas the Army is using a time division multiplex voice carrier. A similar compatibility problem exists between the signalling used by DCS (2600 HZ) and tactical system (1600 HZ).

(3) Although various DOD directives have addressed portions of this problem, the results to date have not been completely satisfactory.^{41, 42} This situation is compounded by the appearance of incorrect data in JCS Publication 11, Tactical Communications Planning Guide (U), dated 1 April 1968 (Secret NOFORN).⁴³ Chapter II of this guide provides the user with information that enables him to determine the specific items of compatible communications equipment available. A complete analysis of JCS Publication 11 is beyond the resources allocated this Board; however, the following are random samples of incorrect information.

(a) Page 159 lists the AN/TCC-13 as being compatible with the AN/TCC-4. (The AN/TCC-13 uses pulse position modulation; the AN/TCC-44 uses pulse code modulation.)

³⁷ These equipments are also incompatible, one with the other, and must be used in pairs.

³⁸ For example, the Army has standardized on 6-bit PCM voice multiplex, DCA is considering standardizing on 8-bit PCM voice multiplex.

³⁹ House of Representatives Report Number 91-693, p. 33.

Headquarters USAF Letter to the Mallard Project Manager, Fort Monmouth, N.J., subject: Initial AF Comments on the Mallard ISSB Report, 20 June 1969.

⁴⁰ Defense Communications Agency, Annual Report of the Director for the Period 1 July 1968 - 30 June 1969 (U), 16 September 1969, p. 45 (CONFIDENTIAL).

⁴¹ These include DOD Directive 4600.1, subject: Telecommunications Policy Objectives, 23 March 1959; DOD Directive 4120.3, subject: Defense Standardization Program, 23 April 1965; DOD Directive 4630.5, subject: Compatibility and Commonality of Equipment for Tactical Command and Control, and Communications, 28 January 1967.

⁴² Consider, for example, the signalling standard problem:

a. Page 81, MIL-STD-188B, Military Communications System Technical Standards, states that the standard signal will be 1600 cps at a level of 0 dbm \pm 4 db.
b. Page 4-4, DCA Circular 330-30-1, Engineering-Installation Standard Manual in detailing the DCS-Non-DCS interface standards states that those signals will be 2600 cps (HZ) at a level of -8 dbm or lower.
c. The effect of the above is that two systems, one designed to MIL-STD-188B, the other designed to the DCS standard will not work together without provision of additional, expensive interface equipment.

⁴³ It is informally understood that the Joint Chiefs of Staff has an effort underway to correct this publication.

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(b) Page 160 lists the AN/TTC-28 as a manual switchboard. (This is an automatic dial switchboard.)

(c) Page 173 lists the AN/FGC-60 as compatible with the AN/TCC-20. The AN/FGC-60 uses 60 milliamperes (MA) of current; the AN/TCC-20 uses 20 MA. The AN/FGC-60 is a four-wire terminal, and each channel transmits and receives using the same two tones. The AN/TCC-20 was designed to use either four-wire or two-wire operation. Therefore, the transmit tone of each channel of the AN/TCC-20 is different than the receive tone; e. g., channel 1 of the AN/FGC-60 has a mean value of 425 HZ for both transmit and receive, whereas channel 1 of the AN/TCC-20 could be sending on a mean frequency value of 425 HZ and receiving on a value of 595 HZ.)

(4) Responsibilities for implementing basic DOD policies affecting the compatibility and commonality of telecommunications equipment are divided among Office of the Secretary of Defense staff offices and agencies.

(a) DOD Directive 4120.3, subject: Defense Standardization Program. This directive appoints the Assistant Secretary of Defense (I&L) as responsible for the Defense Standardization Program (DSP) policy guidance and administration, whereas the Director of Defense Research and Engineering is responsible for engineering policies and determinations required to attain DSP objectives. Action has recently been initiated under this program to establish one single document that will contain all the technical communications-electronics systems standards.⁴⁴

(b) DOD Directive 4630.5, subject: Combatibility and Commonality of Equipment for Tactical Command and Control, and Communications. This directive, which establishes DOD policy, assigns broad responsibilities to principal Staff Assistants to the Secretary without designating any one as having final authority and responsibility.

(c) DOD Directive 5105.19, subject: Defense Communications Agency. In defining the mission and responsibilities of DCA, this directive states that the DCA will provide the engineering standards for both the DCS and for the interface of non-DCS equipment with the DCS. This has been partially accomplished by publication and expansion of DCA Circular 330-175-1, which contains the interface and DCS standards. However, this publication is not complete, e. g., no time division multiplex standards have yet been published.

(d) DOD Directive 5126.22, subject: Assistant Secretary of Defense (Installation and Logistics). This directive designates the Assistant Secretary of Defense (I&L) as the principal staff assistant to the Secretary of Defense in the telecommunications field.

(5) Tri-Service Switch

(a) Perhaps the best example of current commonality and compatibility problems affecting communications-electronics equipment are the problems surrounding the Tri-Service Switch. The original requirement for a tactical electronic switch had been identified in 1956. Initial efforts to develop such a switch failed because of technological problems. However, voice communications problems in RVN affecting the Army, the Marine Corps, and the Air Force generated further, and separate, efforts toward this end. These efforts have resulted in development of the AN/TTC-25 by the Army, the AN/TTC-31 by the Marine Corps, and the AN/TTC-30 by the Air Force. Only the Air Force AN/TTC-30 has been produced in quantity, and that on a limited basis. Contracts for limited numbers of the other two switches have been signed, but only the procurement of pre-production models of each has been authorized.

(b) In January 1969 a Joint Service Coordination Committee was formed to resolve the technical differences and arrive at mutually agreeable specifications. Determining

⁴⁴ASD (I&L) Memorandum, subject: Standardization Area Agreements for Tactical Communications Systems Tactical Standards, 16 December 1969.

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that the solution rested somewhere between the AN/TTC-25 and AN/TTC-31, a comparative evaluation of one against the other was proposed, using pre-production models modified to the new specifications and containing a cost-effectiveness factor based on increased capabilities of one over the other.

(c) The Marine Corps and the Air Force concurred in the compromise specifications and evaluation plan. The Army, however, has not concurred, leaving the matter currently unresolved.

6. CONCLUSIONS AND RECOMMENDATIONS

a. Conclusions

(1) Current plans call for provision of communications support for logistic units to be furnished by common-user systems (paragraph 2).

(2) Two communications systems provide common-user communications support for logistics, the Defense Communications System and the tactical systems (paragraph 3).

(3) Where the fixed-plant portion of the Defense Communications System exists, communications are considered adequate (paragraph 5).

(4) Equipment currently planned to be used to extend the Defense Communications System to geographically remote areas will not provide a high-speed data channel (200 cards per minute) for Automatic Digital Network (AUTODIN) access by common-user elements (paragraph 5b(1)).

(5) The communications resources to provide the quality of in-country communications stated by the Services as required to support a large-scale contingency are limited (paragraph 5d).

(6) Present tactical communications capability will not provide high-speed data (200 cards per minute) links or terminal service in the early stages of a contingency operation (paragraph 5).

(7) There are numerous avoidable compatibility and commonality problems affecting communications-electronics equipment (paragraph 5d).

(8) Planning, compatibility, and commonality problems are aggravated by inaccuracies found in JCS Publication 11 (paragraph 5d).

b. Recommendations. The Board recommends that:

(1) The Secretary of Defense direct necessary actions to achieve a capability for the rapid extension of the Automatic Digital Network (AUTODIN) to remote theaters-of-operations. These actions should include:

(a) Tasking the Director, Defense Communications Agency, to perform systems engineering effort toward providing solutions to the satellite communications transit time effect with a target of establishing high-speed (up to 200 cards per minute) data links via satellites (conclusion (4)).

(b) The AN/TSC-54 mobile satellite terminals be modified to provide at least a 12-channel capacity (conclusion (4)).

(c) Pending the modification of the AN/TSC-54s, the Joint Chiefs of Staff designate two of the existing AN/MSC-46 transportable satellite terminals for support of contingency operations (conclusion (4)).

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(d) The three existing Defense Communications System contingency packages be augmented to include the communications equipment necessary to provide a high-speed data (200 cards per minute) terminal for AUTODIN access, making maximum use of available commercial equipment to provide an immediate capability (CM-5) (conclusion (4)).

(2) The military departments take that action necessary to achieve a high-capacity tactical data transmission capability that is fully compatible with AUTODIN. This should include initiation of the systems engineering effort required to provide message switching and transmission over low-quality tactical communications systems. As a part of this effort, the Navy should continue its engineering development of a reliable high frequency fleet logistic digital data transmission system capable of interfacing with high-speed automated systems ashore (CM-6) (conclusion (5)).

(3) The Joint Chiefs of Staff and the Services ensure that plans for logistical operations recognize the need for alternative methods of transferring data when electrical communications are minimal or disrupted (CM-7) (conclusion (6)).

(4) The Joint Chiefs of Staff direct the action necessary to achieve maximum commonality and compatibility in the acquisition of communications-electronics equipment to sustain joint operations. In addition, the Joint Chiefs of Staff:

(a) Identify the tactical communications-electronics equipment that must interface with the Defense Communications System (conclusions (7) and (8)).

(b) Resolve differences arising between Defense Communications Agency interface standards and tactical communications standards, recognizing unique service requirements (CM-8) (conclusion (7)).

(5) The Joint Chiefs of Staff revise JCS Publication 11, Tactical Communications Planning Guide, to correct numerous technical inaccuracies (CM-9) (conclusion (8)).

CHAPTER V

FIXED AND MOBILE/TRANSPORTABLE COMMUNICATIONS

1. **INTRODUCTION.** This chapter uses the experience gained in Vietnam to recommend actions to enhance early acquisition of a high-capacity, high-quality communications capability to support development of logistical complexes in a theater-of-operations.

2. **BACKGROUND**

a. At the start of a contingency operation, elements of tactical communications units are immediately deployed to provide service as quickly as possible. However, as the operation and the population at the deployment location increase the communications needs become more sophisticated and complex. These needs rapidly saturate the capabilities of the mobile/transportable communications equipment that was initially deployed.¹ To provide an expanded capability with high-quality service (e.g., dial telephone service to 1000 subscribers) it is necessary at the present time to initiate a series of fixed-plant projects. No intermediate capability exists between the low-capacity, low-quality (but quick reaction) capability of mobile/transportable communications equipment designed for operation over a limited period of time, and the high-capacity, high-quality service provided by fixed-plant communications.² This situation is not satisfactory, as demonstrated by the SE Asia experience.

b. As described in detail in Chapter II and Appendixes B through E of this monograph, substantial effort was expended in SE Asia to provide communications. These communications were initially of the mobile/transportable category which were organic to the deployed tactical units and were supplemented by communications contingency assets of the Services. These were later replaced as the basic communications in SE Asia evolved into fixed-plant systems.

(1) The installation of fixed-plant communications, including dial central offices, message and data switches, and part of the intra-theater trunking, was a time-consuming process. Permanent buildings were erected and communications were engineered and installed on a site-by-site basis. It was not until 1967, more than 2 years after the initiation of the requirements, that substantial numbers of fixed-plant installations began to be cut over to service.

(2) The SE Asia experience highlighted the two distinct disadvantages of the replacement of mobile/transportable assets with fixed-plant equipment.

¹The following definitions apply:

Mobile/Transportable - communications equipment that is not operable while moving but which can be transported and made operational within hours, without extensive site preparation.

Heavy Transportable - transportable communications equipment containing the same or similar C-E and power equipment to that used in fixed facilities and which provides a capability for sustained operations approaching that of a fixed-plant facility.

Fixed-Plant - communications equipment, which, once installed, is permanent in nature and not normally relocated.

²There are individual items that can provide medium-quality links, e.g., AN/MRC-113s. However, the total complement of equipment required to provide a high-quality system is not available. Such missing items as high-capacity technical control facilities, preclude high-capacity, high-quality systems capability from being achieved.

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- (a) Fixed-plant equipment takes too long to engineer, procure, and install.
- (b) The assets are not easily recoverable.

3. **POLICY GUIDANCE.** Recognition of these disadvantages has led to the following Office of the Secretary of Defense (OSD) policy: "... all new overseas requirements for communications facilities and equipment must be satisfied through application of 'transportable' configurations unless specifically justified and approved otherwise."³

4. **CURRENT EFFORTS.** This policy guidance confirmed the efforts that had been previously undertaken to provide a heavy transportable communications capability for extension and/or restoration of the Defense Communications System (DCS):

- a. 11 July 1967. The Secretary of Defense directed DCA to submit an economic, technical, and operational feasibility study and a Technical Development Plan (TDP) for development of a family of heavy transportable communications equipment.⁴
- b. 8 August 1967. DCA established a working group to prepare the feasibility study.⁵
- c. 18 December 1967. DCA forwarded the feasibility study to DOD through the Joint Chiefs of Staff.⁶
- d. 22 May 1968. DCA requested the Department of the Navy to prepare a Technical Development Plan for this effort.⁷
- e. 15 December 1969. The Department of the Navy submitted the Technical Development Plan.⁸

5. DEFICIENCIES

a. The above series of actions indicates that the provision of DCS communications via heavy transportables has been initiated and action is proceeding to acquire this capability. There is, however, a further need which those actions will not fill, e.g., those requirements for high-capacity, high-quality communications services that are not provided by the DCS. These requirements include local base communications facilities such as dial central offices and local communications centers of the tactical communications system.⁹

³Deputy Secretary of Defense Memorandum, subject: DCS Transmission Facilities, Thailand, Subsystems Project Plan 1-69 (U), 30 November 1968.

⁴Secretary of Defense Memorandum, subject: Calendar Year 1967 Communications Review Issue #6, Transportable Communications for the DCS, 11 July 1967.

⁵DCA Letter 514/802-09, subject: Establishment of the Working Group on Heavy Transportable Communications Equipment, 8 August 1967.

⁶DCA Memorandum, subject: Transportable Communications Equipment in Fixed Long-haul Communications System, 18 December 1967.

⁷DCA Letter, subject: Development of a Family of Heavy Transportable Communications Equipment, 22 May 1968.

⁸This Technical Development Plan is currently under evaluation at DCA.

⁹The scope of these requirements is shown from SE Asia experience:

- a. By the end of 1968, more than 28 local fixed-plant dial central offices had been installed by the Services in RVN with a total capacity of over 46,000 lines. USMACV, Command History, 1968 (U), 30 April 1969, p. 717 (TOP SECRET).
- b. By July 1968, 13 area communications centers had been built as fixed-plant facilities as part of the Army Area Communications System in RVN. 1st Signal Brigade, Command Progress Report, 4th Qtr-FY 68 (U), 6 August 1968, p. IV-40 (CONFIDENTIAL).
- c. By July 1968, 14 fixed-plant base communications centers were installed by the Air Force (Air Force Program, Communications-Electronics Support Program (PCSP)).
- d. By May 1968 the Naval Shore Electronics Engineering Activity Pacific (NAVSEEAPAC) has constructed five fixed-plant communications centers to support Marine Corps operations in I CTZ. (CGFMFPAC ltr 10B/bkh, 4000 of 21 June 1969, subject: Joint Logistics Review Board Requirements.)

b. To date, it does not appear that the Services have oriented their high-quality, high-capacity communications programs toward implementation of the previous OSD guidance. For example, the non-DCS communications facilities identified above are capable of being pre-engineered.¹⁰ If this were done, then purchase of the bill-of-materials and installation of the material into a standard van (or container) could be accomplished in the United States.¹¹ The equipment could then be rapidly shipped overseas as a unit for immediate emplacement, thus avoiding many of the engineering and overseas installation delays encountered in the RVN build-up (see Appendixes C, D, and E). The Army, the Navy, and the Air Force have programs that are designed to provide pre-engineered bills-of-materials for fixed-plant communications facilities.¹² It appears that these programs could easily be modified to engineer similar facilities for transportable containers.¹³

6. CONCLUSIONS AND RECOMMENDATIONS

a. Conclusions

(1) There is a clear need to provide high-capacity, high-quality communications in a theater-of-operations as forces and installations expand. This type of communications was provided in RVN by fixed-plant projects (paragraph 2).

(2) Office of the Secretary of Defense guidance is that these communications requirements will be provided by transportables (paragraph 3).

(3) An effort is in progress to acquire this capability for the extension and restoration of the Defense Communications System (paragraph 4).

(4) There are other communications needs besides those satisfied by the Defense Communications System that require this type of communications capability (paragraph 4).

(5) The military departments can orient their pre-engineered, fixed-plant facilities programs to provide for heavy transportables (paragraph 5).

b. Recommendations. The Board recommends that:

(1) Heavy transportable modular communications equipment for Defense Communications System restoration or extension be acquired at the earliest practicable date (CM-10) (conclusions (1), (2), and (3)).

(2) The military departments orient their pre-engineered fixed-plant facilities programs to include heavy transportable communications equipment incorporating the modular concepts recommended for Defense Communications System restoration and extension (CM-11) (conclusions (4) and (5)).

¹⁰This assumes that standard off-the-shelf currently available commercial equipment is used.

¹¹An in-depth review of the advantages of using containers is provided in an Appendix to Chapter VI of the Transportation Monograph.

¹²The following use the building-block concept for maximum flexibility:

a. Army Fixed Signal Communications Facilities Program (Department of the Army Technical Bulletin, TB Sig 322-1, 22 March 1968).

b. Navy Advanced Base Functional Components System (Department of the Navy OPNAV Instruction 4040.22C, 15 October 1963).

c. Air Force - Standard Facility Equipment Listings (SFELs) (Department of the Air Force Technic. Order, TO 3123-10-1-2).

¹³For example: Coded facility - 320, Accessory Equipment for a Communications Center (TB Sig 322-320), could be readily expanded to provide the basic engineering required to install accessory equipment in a transportable communications center.

CHAPTER VI

AUTOMATED SYSTEMS AND COMMUNICATIONS

1. INTRODUCTION

a. Any estimate of the impact of communications on logistics must give serious consideration to the impact of Automatic Data Processing (ADP), as a major tool of logistics, on communications. Because of its exceptional growth rate and varied applications, the development of ADP systems has often been out of phase with the communications systems upon which they must rely. To ensure total system satisfaction, close coordination between ADP system planners and communications planners is essential.

b. This chapter will examine the problems of automated systems and communications as they have evolved and will attempt to draw on them for future guidance.

2. BACKGROUND

a. In examining the communications situation as it developed in Vietnam between 1965 and 1969, and as is evident in current contingency planning (see Chapter IV), the communications support required by the logistics services has generally exceeded the capability of communications when operations have been extended beyond the established Defense Communications System (DCS).

b. In Vietnam the tactical system was upgraded by the construction of fixed-plant facilities, engineering improvements to the mobile/transportable installations, and installations of undersea cables. It was 3 years after the large-scale troop buildup began before a fully automated data transmission system was functioning. Prior to this, it had been necessary to use air courier service to ensure the delivery of card batches to offshore addressees. Such a system was unsatisfactory to the customer and failed to make the best use of automatic data processing procedures as a management tool, which the electrical exchange of logistic information had been developed to enhance.

c. Experiences of the Seventh Fleet during the same period indicated serious shortcomings in the ship-to-shore digital data links. The existing HF data link, with its limited transmission capability of 6 to 10 cards per minute, proved to be too slow to handle the volume of logistic traffic originated by fleet units with installed ADP equipment.¹ These problems led to engineering research efforts directed toward developing an HF data communications system capable of interfacing with automated systems ashore. To handle the mounting supply traffic load to the fleet, the assignment of a logistics channel on the fleet multichannel broadcast is also being considered.

d. During the last 5 years, the proper functioning of the Services' logistic systems has become almost completely dependent on AUTODIN for long-haul communications. Where

¹During 1967 about 70 major ships employed logistic and supply computer systems. The effectiveness of these systems was seriously limited by a lack of adequate digital data communications means. Likewise, the overall effectiveness of computer systems used throughout the Naval Material Support Establishment (NMSE) was limited by the inadequate data communications with commands afloat which the NMSE must support.

this network exists, its capacity is adequate and there is a continuous program of system improvement.²

3. COMMUNICATIONS REQUIREMENTS AND CAPABILITIES. Current planners foresee the rapid extension of the DCS into the theater-of-operations and an immediate requirement for the transmission of digital data from there to out-of-theater addressees. However, to meet this requirement communications links, switches, and terminal equipment must be installed. This installation requires considerable time and effort, and consists of the following.

a. Transmission Media³

(1) Submarine Cables. These cables were of great value both within Vietnam and as out-of-country links. Capable of providing a large number of channels and of being conditioned to meet the quality specifications required for digital data transmission speeds in excess of 200 cards per minute now normally used on AUTODIN, the submarine cable offers advantages over other electronic means for long-haul circuits. Installation costs, both in terms of time and money, are serious drawbacks when considering deployments in areas where such service does not presently exist. In addition, these cables offer limited flexibility, are subject to being cut, and have a low recoverability rate.

(2) Fixed-Plant Land Lines. These lines, including open wire, polyethylene insulated multipair cable, and coaxial cable have the same characteristics and capabilities, when properly installed, as submarine cables. (This does not include the lines consisting of field wire.) These lines provide greater flexibility and are easier to maintain than submarine cables; however, land lines are considerably more vulnerable and suffer from the same time constraints for installation.

(3) Tropospheric Scatter (Tropo) Links. These links possess a high channel capacity. When installed and maintained with adequate engineering preparation and technical control facilities, they are capable of providing the high-quality channels required for high-speed data transmission. Because there is no completely adequate theory of tropo-scatter propagation, links using this technique are subject to anomalies. Recognizing these factors, however, tropo links generally have a reliable range of up to 320 km, depending on the circumstances under which they are installed.

(4) Microwave Radio. These links, like tropo, have a high channel capacity. They are generally limited to line-of-sight for high-quality systems (approximately 48 km per link).

(5) High-Frequency (HF) Radio. Although capable of providing long-range voice and teletype circuits, the use of HF radio has not been completely satisfactory for transmission of data.⁴ The bandwidth characteristics of commonly used HF links limit channel derivation to four voice channels. In addition, this media suffers from overall frequency congestion with its associated interference, as well as sky-wave fade. In view of the long-range capability of HF, efforts have continued to enable high-speed data channels to be derived through this means; however, complete success has not yet been achieved.⁵

²See the following document for the current description of some of these on-going efforts. Defense Communications Agency, Annual Report of the Director for the Period 1 July 1968 - 30 June 1969(U), 16 September 1969, pp. 20-27 (CONFIDENTIAL).

³There are other media which are not mentioned (e.g., ionospheric scatter) at they are not in common use and do not project any substantial operational utilization.

⁴This was the means used between RVN and Okinawa from 1965 to 1967 and its performance at 3-10 cpm was generally unsatisfactory because of its limited capacity and its high error rate.

⁵Among others, the Navy is actively engaged in projects to achieve an improved HF radio digital data transmission capability. See, for example, ACNO, Study, Automatic Data Processing (ADP) Impact on Naval Communications, April 1969 (CONFIDENTIAL).

(6) Satellite. The use of communications satellites offers an alternative means for long-distance links; however, like HF radio, communications satellites are currently restricted in channel capacity and data speed. At present further research and development is necessary in both the satellites and the ground terminals necessary to communicate with them before they can satisfy high-capacity military digital transmission requirements.⁶ When developed, this system is expected to be particularly responsive to contingency situations and long-distance needs.

b. Switching Capabilities

(1) In addition to the transmission requirements of data systems, there is a corresponding need for switching (relay) facilities. In RVN, data switching facilities did not exist in January 1965 (Phu Lam was a terminal in the interim AUTODIN system). In March 1965, Phu Lam became a Manual Data Relay Center (MDRC) and by August 1965, served four subscribers and had trunks to Clark AB and Fort Buckner. A second MDRC was activated at Nha Trang in August 1967. In March 1968 an automatic switching center was activated at Phu Lam. In June 1968 the automatic switching center at Nha Trang was activated. Their traffic load in December 1968 was an average of 22,900 messages per day to and from six out-of-country stations, while serving 48 subscribers.⁷

(2) During the construction of these switches, communications were undergoing the transition from torn tape teletype in the DCS to digital data switching. As a result, operations continued despite the prolonged construction period. With the demise of teletype in the DCS, planners for future operations are faced with the requirement of providing digital switching facilities much earlier than was done in RVN. Such provisions would have to be made in most instances by the use of mobile/transportable equipment that has not been built.

c. Terminal Equipment. The requirement for digital terminal equipment in RVN is currently being satisfied by using commercial equipment installed in fixed-plant facilities. Development and testing of mobile/transportables have progressed to the stage where some van mounted commercial equipment has been shipped to RVN for operational use.⁸ However, further effort is necessary in this area.

4. COORDINATION

a. An examination of the automated logistic systems currently in use, which require extension into the theater-of-operations, and those contemplated for use in the near future by the Services indicates a concurrent requirement for increased communications capabilities. (In 3 years, 1966 through 1968, the number of computers used by DOD increased from 1998 to 2658.)⁹ Although not all computers require or impose a demand on communications, many do. Of those that do, each requires its share of a communications system that may not exist in terms of quality and quantity.

b. In the past, planning for communications support was often accomplished after the computer system was designed.^{10, 11} The problems inherent in this procedure, when further

⁶DCS Plan 71/81, Volume III, March 1969 (SECRET). Problems include derivation of multi-voice channels, systems, engineering effort on the transit time effect, and others.

⁷DCS, Communications Management Handbook, 4th Qtr-CY 68 (CONFIDENTIAL).

⁸The Marine Corps has shipped two such units to III MAF. They have not been placed in operation at this time.

⁹General Services Administration, Inventory of Automatic Data Processing Equipment in the United States Government, FY 68, p. 18.

¹⁰Assistant Secretary of Defense (Installation and Logistics) (ASD) (I&I.) Memorandum, subject: Automated Logistics Systems Concepts, 11 August 1969, Enclosure XVII.

¹¹An example is the introduction of computers to support the supply system of III MAF in 1965. No satisfactory communications system existed to transmit digital traffic to Okinawa, the Marine Corps' major off-shore base, until 1967.

complicated by the large number of unrelated systems in existence, using a variety of hardware and software, multiplied the problems of standardization. At the same time communications programs were initiated without adequate regard for ADP requirements or implications.¹² The problem has been recognized and action initiated to ensure the future cooperation and coordination of the user, the ADP system planner, and the communicator.^{13, 14}

c. There is a gap between the plans to provide automatic data processing support for a contingency operation and the capability to connect this system (ADPE or terminals) into AUTODIN from a remote theater-of-operations. The communications problems of connecting the ADP user in the theater-of-operations to AUTODIN are discussed in paragraph 3. There is the further problem of commonality, which has a direct bearing on the effectiveness and efficiency of the entire system.

(1) Current logistic support systems include the use of a number of different types of computers that are not necessarily compatible. If provision is not made for the interface equipment required to permit entry directly into AUTODIN and uninterrupted transmission to the addressee(s), a manual mode of interface, with its attendant delays, will be required. The impacts of the delay include:

- (a) A less responsive combat service support system.
- (b) An increase in pipeline inventory cost in the number of days of stockage required to cover the gap.
- (c) A further increase in number of line items carried.

(2) As detailed in Chapter IV, however, the plans to provide communications support for these systems have not matured.

5. COST CONSIDERATIONS

a. In addition to recognizing the practical necessity for cooperation between communications and ADP, particular emphasis needs to be placed on the cost factor. The truly cost effective system must carefully consider telecommunications—not after other requirements are determined—but in the determination of requirements as a part of the closed loop concept of systems design with feedback.¹⁵

b. A brief review of some of the outstanding communications costs indicates that:

(1) In Vietnam the cost of Army fixed-plant C-E facilities from 1 January 1965 has totaled \$300,837,368;¹⁶ the Air Force 439L Coastal Cable Project cost \$44,000,000.¹⁷ These figures do not purport to represent the total cost of communications in RVN, but they do serve as an indicator of such costs.

¹²ASD (I&I) Memorandum, subject: Programming of Telecommunications Requirements in Support of ADP and Telecommunications Systems, 13 May 1969.

¹³Ibid.

¹⁴Assistant Chief of Naval Operations (ACNO) (Communications) Memorandum, subject: ADP Systems and Communications, 13 February 1969.

¹⁵ASD (I&I) Memorandum, subject: Automated Logistics Systems Concept, 11 August 1969, Enclosure XVII, p. XVII-5.

¹⁶Assistant Chief of Staff for Communications-Electronics, Department of the Army, Memorandum, subject: Cost of Communications Facilities Build-up in Vietnam, 3 September 1969.

¹⁷Page Communications Inc., Letter, subject: IWCS, 1 May 1969.

(2) The Army estimates the initial cost to meet the doctrinal requirement for communications units for an "Eight Division" Theater Army as \$493,943,000, with an annual sustaining cost of \$348,198,000.¹⁸ The Air Force annual operating cost for five Mobile Communications Groups is \$37,953,000, with an acquisition cost of \$83,858,375 (this includes flight facilities equipment, e. g., TACAN, which is normally provided by these groups).¹⁹ The communications to be provided are tactical and are not designed to support high-speed digital data requirements.

c. The expenditure of such sums of money is of particular importance now in view of the increasingly stringent requirements of the data processor, requirements which can be satisfied only with improvements in quality and quantity of communications systems. The impact of these requirements is to place a severe strain on current capabilities and in some cases to exceed them.^{20,21}

6. VULNERABILITY. The current trend in logistics management presumes that there will be centralized data banks with a minimum of duplication and that these data banks will be accessible through remote input and output devices relying on sophisticated and compatible interface equipment and communications networks.²²

a. In achieving such a complete and interrelated system as is envisioned in the above, it is necessary to consider a potential and serious drawback—vulnerability. All means of communications are subject to disruption through jamming and/or destruction. Restoration of the affected portions of the system could be undertaken within a short time; however, the extent of destruction and damage would dictate the amount of time that users would be without communications or with limited communications. Primary reliance of the operating forces on such a delicate system must be considered in logistic systems planning.

b. Any major interruption in the flow of data might well find users dependent on such a system without the equipment, personnel, or knowledge to continue operations. The probability of interruption of communications links during a major war has to be seriously considered and establishes an untenable risk for those systems solely reliant on these links. To counter such a risk requires that support units be capable of continuing to provide support, perhaps in a less-efficient manner, when communications have been interrupted.²³ Several aspects of this could include:

- (1) Alternate storage of key data in theaters-of-operations.
- (2) Alternate modes of operation.
- (3) Delivery of cards by air courier to the nearest operable AUTODIN switch or terminal.

7. CONCLUSIONS AND RECOMMENDATIONS

a. Conclusions

(1) Automated logistic systems are currently dependent on a high-quality digital communications network (paragraph 2b).

¹⁸Assistant Chief of Staff for Communications-Electronics, Department of the Army, Memorandum, subject: Logistical Requirements for Communications Support, 3 September 1969.

¹⁹Information provided by Air Force Communications Service.

²⁰ACNO (Communications) Memorandum, subject: ADP Systems and Communications, 13 February 1969.

²¹Assistant Chief of Naval Operations (Communications and Cryptology), Automatic Data Processing (ADP) Impact on Naval Communications, April 1969, p. 1.

²²ASD (I&L) Memorandum, subject: Automated Logistic Systems Concept, 11 August 1969, Enclosure XVII.

²³See Memorandum of the Special Assistant for Plans, Office of the Assistant Secretary, Department of the Army, for Dr. Fox, subject: Automated Logistics System Planning, 29 August 1965.

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(2) Automatic Digital Network (AUTODIN), where it exists, is capable of satisfying logistic data transmission requirements in terms of quality and quantity for the foreseeable future (paragraph 2).

(3) The capability to extend the data transmission network AUTODIN to and throughout a remote theater-of-operations is currently limited but is an absolute requirement (paragraph 3).

(4) There is a coordination gap between ADP and communications planners (paragraphs 4 and 5).

(5) Communications are vulnerable to interruption and interruption will affect the flow of logistic data. This factor, plus the dependence of the automated systems on high-quality, high-capacity communications requires provisions for:

(a) Alternate means of communications.

(b) Alternate means of operation without placing total reliance on centralized data banks. (paragraph 6).

b. Recommendation. The Board recommends that:

(1) In the development of concepts and planning for automatic data processing equipment to support logistics, the Services give full and specific consideration to the requirements placed on communications, available capabilities, capacities, vulnerability, and costs and to tradeoffs between the requirements for data and for communications (CM-12) (conclusions (1) through (5)).

CHAPTER VII

SUMMARY

1. **OVERVIEW.** The war in Vietnam resulted in unprecedented logistic communications demands that in large measure had not been anticipated or planned for prior to 1965. The United States was committed to a conflict in an underdeveloped country on the other side of the globe which lacked sufficient means of communications to support adequately the limited forces in-country prior to the buildup. Despite this fact and the many inconveniences and difficulties as well as numerous shortfalls, the necessary communications were generally provided by one means or another. By mid-1968 most of the problems had been overcome. Thus, the history of communications in Vietnam includes strengths as well as weaknesses.

a. Communications requirements in Vietnam were profoundly affected by automatic data processing demands for the electrical transmission of digital data. These transmissions, which were vital to logistics users, required circuits of particularly high quality. At the same time, the transition from teletype operations for message traffic at 60 to 100 words per minute to digital data techniques at 200 words per minute placed an increased burden on the tactical communication system tying into the Automatic Digital Network (AUTODIN), for improved switching and relay facilities as well as for high-quality circuits. The poor quality of the circuits in-being prior to mid-1967 introduced unacceptable error rates into logistics transactions. This necessitated the wide use of aircraft courier flights in-country and to Okinawa for the transfer of card traffic. Ultimately a satisfactory high-speed fixed-plant data communications system was constructed that was capable of automatic transmission and routing of both narrative and logistic traffic.

b. To provide the necessary communications on which current logistics depends to such a great extent, a series of actions were taken throughout the era, the most significant of which occurred in the 1965 to mid-1968 time frame. This communications system is currently operating in satisfactory fashion. Consequently, the review of communications and its impact on logistics in the Vietnam conflict presented in this monograph emphasizes planning activities, the requirements generated during the buildup, and the means by which these requirements were met.

c. The buildup of the necessary communications capabilities lagged user requirements during the first years of the war. There were deficiencies in both the quantity and the quality of communications, particularly to meet logistic requirements. The magnitude of the tasks, the graduated nature of the buildup with the resultant escalation and instability of programs, the lack of satisfactory statements of requirements, shortages of personnel and equipment, and other constraining factors created significant problems in providing the required services and prevented communications from developing concurrently with the rapid troop and logistic buildup. Plans were developed in the early stages of the war to upgrade the long-haul systems with fixed-plant facilities; however, such facilities require extended periods for justification, design, and installation. Thus it was not possible to keep pace with demands. The situation was exacerbated by changing troop commitments, redeployments, expanding information needs, and digital communication requirements related to the introduction of automated data processing systems.

d. Contrary to fundamental principles establishing the inseparability of military operations and military communications, both of which are a command responsibility, the Commander, United States Military Assistance Command, Vietnam (COMUSMACV), found himself with inadequate authority over communications in Vietnam during 1965. Segments of the system fell under

the authority of U.S. Army Support Command, Vietnam (USASCV); STRATCOM-PAC; Defense Communications Agency (DCA), which reported to DCA-PAC via USASCV; and the U.S. Air Force, under operational control of the 2d Air Division. The tactical portions of the system fell under the Service components; however, no clear-cut decisions had been made in the case of the long lines system as to what was tactical and what should be designated for long line management under DCA. This fragmentation of authority was a contributing factor in operational and planning problems.

e. A submarine cable from Vietnam to the Philippines, where entry was made into the worldwide system, was completed on 31 December 1964. However, further actions were necessary to overcome the lack of high-quality circuits to Okinawa. Also, alternative routing with which to back up the cable was not available. These difficulties were not resolved until mid-1967.

f. Interim actions were taken to meet the developing communications requirements in-country by employing mobile/transportable equipment. This equipment was not always available in the quantity desired and it did not meet all requirements for quality; nevertheless, its flexibility, availability, performance, and relative ease of installation must be cited as strengths of communications support in Vietnam. The importance of mobile/transportable equipment is evidenced by the fact that as late as October 1967 it provided approximately 70 percent of the Defense Communications System circuits in Vietnam.

g. These paragraphs have summarized the essence of the logistic communications situation as it developed in Vietnam. A detailed review of the situation focused attention on four primary topic areas for in-depth review and analysis:

- (1) Logistic Communications Requirements and Planning.
- (2) Readiness for Contingencies.
- (3) Fixed and Mobile/Transportable Communications.
- (4) Automated Systems and Communications.

Major lessons learned and the 7 most significant of the 12 recommendations developed within this monograph are discussed below.

2. LOGISTIC COMMUNICATIONS REQUIREMENTS AND PLANNING

a. Lessons Learned

(1) Communications support of logistics in theaters-of-operations needs more adequate coverage in Service doctrine, and more-detailed coverage in operations and administrative plans and orders.

(2) The method projected for satisfying logistic communications requirements in Vietnam was the common-user system. This system proved to be lacking in responsiveness to requirements that were largely unforeseen and was supplemented by dedicated circuits. By December 1968, 55 percent of all the Defense Communications System circuits in Vietnam were dedicated. Logistics, with 14 percent of these circuits, was the second largest user.

(3) The Vietnam experience emphasized the need for early recognition of specific logistic requirements for communications so that adequate programming is ensured to fulfill these requirements along with those of many other users. To accomplish this, it is necessary to identify all the customers who require service and the types of service that are needed. Ideally, logistic requirements for communications should be specified at the doctrinal level. At the least, these requirements should be identified by the time contingency plans are prepared.

The Joint Logistics Review Board has been unable to find any evidence that the Vietnam experience has led to identification and validation of overall specific logistical requirements for communications services nor has it been reflected in overall doctrine or planning.

b. Recommendations

(1) The Joint Chiefs of Staff instructions for contingency planning give specific reference to the identification of logistic requirements for communications and the means of gaining access to the Automatic Digital Network system (CM-1).

(2) The Services include the identification, quantification, and justification of specific logistic requirements for communications as part of their basic doctrinal reviews and studies, e.g., the Army--80 series of studies (CM-2).

3. READINESS FOR CONTINGENCIES

a. Lessons Learned

(1) Current plans for providing communications support for logistics units, in accordance with Service doctrine, call for the support to be furnished by common-user systems. Both the Defense Communications System and the tactical communications systems provide this common-user support. Communications experiences in Vietnam provide evidence of shortcomings in this support.

(2) To ensure entry into the Defense Communications System by deployed forces, the planner must consider both the Defense Communications System and the tactical communications system that serve the theater. Rapid and reliable transmission is ensured once entry is made into the appropriate major common-user subsystem of the Defense Communications System either AUTODIN or Automatic Voice Network (AUTOVON).

(3) Communications are considered adequate in these areas of the world in which the fixed-plant portions of the Defense Communications System exist. However, not all significant areas of the world are within reliable communications range of a station. The Defense Communications System serves most of the important areas of the world with four exceptions: the Indian Subcontinent, the Middle East, Africa south of the Sahara, and South America. Extension of this system into these areas would currently require the same type of equipments used in Vietnam, notably high-frequency single-sideband radio and satellite circuits. Both of these systems have limited capabilities and are generally unsatisfactory for high-speed digital data transmission. A number of actions are required to provide and/or ensure logistic units with the necessary high-speed access to AUTODIN. These actions are covered by specific recommendations.

(4) The tactical system in the theater-of-operations presents a different problem. Tactical equipment is designed for rapid emplacement and its use does not provide the quality and capacity needed for high-speed data transmission over an extended period of time. Furthermore, tactical data terminals and data switching equipment are not available in required numbers, and tactical switching systems are not automated.

(5) The development and acquisition of different types of communications equipment, with essentially the same function and capability (including those cases in which there has been marginal improvement in performance), are creating significant operating problems in the field. This problem is further compounded by development efforts that have resulted in a variety of equipment types that are not compatible with one another and, in some instances, are not compatible with the Defense Communications System even though interface requirements exist.

b. Recommendations

(1) The Secretary of Defense direct necessary actions to achieve a capability for the rapid extension of Automatic Digital Network (AUTODIN) to remote theaters-of-operations. These actions should include:

(a) Tasking the Director, Defense Communications Agency, to perform systems engineering effort toward providing solutions to the satellite communications transit time effect with a target of establishing high-speed (up to 200 cards per minute) data links via satellites.

(b) The AN/TSC-54 mobile satellite terminals be modified to provide at least a 12-channel capacity.

(c) Pending the modification of the AN/TSC-54s, the Joint Chiefs of Staff designate two of the existing AN/MS-46 transportable satellite terminals for support of contingency operations.

(d) The three existing Defense Communications System contingency packages be augmented to include the communications equipment necessary to provide a high-speed data (200 cards per minute) terminal for AUTODIN access, making maximum use of available commercial equipment to provide an immediate capability (CM-5).

(2) The military departments take that action necessary to achieve a high-capacity tactical data transmission capability that is fully compatible with AUTODIN. This should include initiation of the systems engineering effort required to provide message switching and transmission over low-quality tactical communications systems. As a part of this effort, the Navy should continue its engineering development of a reliable high-frequency fleet logistic digital data transmission system capable of interfacing with high-speed automated systems ashore (CM-6).

4. FIXED AND MOBILE/TRANSPORTABLE COMMUNICATIONS

a. Lessons Learned

(1) The initial deployment of communications units in a contingency is made with equipment that can be rapidly placed in operation. However, the resulting system is limited in both capacity and quality. Furthermore, it has limited durability and requires a great deal of maintenance after relatively short periods of operations. After it is no longer required, the recovery of fixed-plant equipment is difficult and limited.

(2) In Vietnam, it was necessary to replace the tactical equipment initially employed in Defense Communications System circuitry with fixed-plant installations. Although this solved the major problems, there was a period of more than 2 years before communications were satisfactory.

(3) These lessons learned have emphasized the need for a communications system that is better than tactical and more responsive than fixed-plant and can be recovered when no longer required. This need has led to:

(a) A Department of Defense policy calling for the use of transportable configurations to meet new overseas requirements. Exceptions must be specifically justified and approved.

(b) Confirmation of previous efforts to provide heavy transportables for Defense Communications System extension and/or restoration. Efforts are currently at the Technical Development Plan stage.

(4) Communications systems other than the Defense Communications System require the same high-capacity, high-quality capabilities. Such capabilities could be provided

by mobile/transportable equipment. The military departments can orient their pre-engineered fixed-plant facilities programs to provide for heavy transportables.

c. Recommendations

(1) Heavy transportable modular communications equipment for Defense Communications System restoration or extension be acquired at the earliest practicable date (CM-10).

(2) The military departments orient their pre-engineered fixed-plant facilities programs to include heavy transportable communications equipment incorporating the modular concepts recommended for Defense Communications System restoration and extension (CM-11).

5. AUTOMATED SYSTEMS AND COMMUNICATIONS

a. Lessons Learned

(1) The increasing numbers of automatic data processing systems in the logistics field have had major impacts on both quality and quantity requirements for communications. These systems have data transmission quality requirements far exceeding those used in tactical communications. Furthermore, the extension of these systems further forward in theaters-of-operations has created demands for communications beyond existing capabilities.

(2) In Vietnam, 3 years of upgrading the communications system were required before a satisfactory level of quality to handle the demand of digital traffic was achieved. The Navy, which relies primarily on high-frequency radio links for long distance communications with fleet units, has not yet developed a satisfactory digital data transmission system to take full advantage of automatic data processing efficiencies and economies.

(3) Although AUTODIN provides satisfactory service for the automatic data processing user, serious problems are encountered once it is removed from easy access to it. Major problems in this respect are:

(a) Shortcomings in the commonly available transmission means (i.e., high-frequency radio, tropospheric scatter and microwave radio, and cable systems both submarine and land line). Satellites, with their attendant ground terminals, have excellent potential but are not now satisfactory.

(b) Switching facilities must currently be fixed plant as there is no tactical capability.

(c) Most terminal facilities at subscriber locations currently require fixed-plant installations. However, some van-mounted equipment has been fielded and is currently awaiting operational test.

(4) A high degree of cooperation, coordination, and liaison between automatic data processing and communications is essential to ensure that compatibility and commonality problems of the systems and equipments are solved in the planning stage. This is necessary to avoid activation and operational delays and to eliminate the use of expensive interface equipment.

(5) As major users of communications systems with particularly stringent requirements, automatic data processing planners must consider communications requirements when measuring cost effectiveness and in planning for implementation.

b. Recommendation

(1) In the development of concepts and planning for automatic data processing equipment to support logistics, the Services give full and specific consideration to the requirements placed on communications, available capabilities, vulnerability, and costs and to trade-offs between the requirements for data and for communications (CM-12).

APPENDIX A

BACKGROUND TO 1 JANUARY 1965

1. PURPOSE. The purpose of this appendix is to provide a historical background of the status of communications in support of logistics in Vietnam and major supporting areas up to 1 January 1965.

2. GENERAL. The involvement of the U.S. Military Forces in Vietnam dates from 23 December 1950 when the United States signed a pentilateral agreement with France, Vietnam, Cambodia, and Laos. This agreement provided indirect U.S. military aid to those nations and established a U.S. Military Assistance Advisory Group (MAAG) in Saigon. During the early 1950s Viet Minh forces established control over the north, which was then severed from the south near the 17th parallel on 26 December 1953. On 7 May 1954, Dien Bien Phu fell to the enemy and shortly thereafter French forces left Vietnam. Subsequently, as pressure throughout SE Asia increased, the United States steadily expanded its advisory efforts in support of the armed forces of South Vietnam. In February 1962, the growing MAAG Vietnam organization became the Military Assistance Command, Vietnam (MACV), under the command of General Paul B. Harkins,¹ and by 31 December 1964, the number of U.S. troops of all the Services in RVN had increased to about 23,000.²

3. COMMUNICATIONS LINKS TO VIETNAM. Modern electric communications facilities were virtually absent in South Vietnam until large U.S. military developments, together with civilian aid programs, began in the early 1960s. Previously, there existed some commercial radio service in-and out-of-country and minor French telephone (Postes Telegraphs et Telephones - PTT) service within and between a few of the larger towns. Those facilities that existed were extremely limited both in quality and quantity. The intercity and overseas facilities were operated largely on a scheduled but part-time basis by means of high-frequency (HF) radio.³ To provide communications it was thus necessary to establish the basic systems almost from scratch.

a. Initial Communications. Early in 1951, a radio station in the U.S. Army Command and Administrative Net (ACAN) was put into operation in Saigon to service the MAAG. This station provided a single-channel, high-frequency (HF) teletype link to Clark Air Base in the Philippines. During the following period, additional radio facilities, large single sideband units (SSB), were installed in Saigon, increasing the number of voice and teletype channels eastward to Okinawa and the Philippines, and westward to Bangkok. By the end of 1964, direct DCS HF channels existed from Vietnam to San Miguel, the Philippines, to Bang Pla, Thailand, and to Fort Buckner, Okinawa, as shown in Figure A-1.⁴ In addition to the Defense Communication System (DCS), there were unique service HF systems also extending circuits out of RVN. For example, by the end of 1964, the Marines had one HF SSB voice circuit to Marine Corps Air

¹United States Army, Pacific (USARPAC), History of the U.S. Army Buildup and Operations in the Republic of Vietnam (RVN) 1 January 1961 to 31 January 1963 (U), 18 November 1963, pp. 28-30, 47 (TOP SECRET).

²USARPAC, History of U.S. Army Operations in Southeast Asia, 1 January 1964 to 31 December 1964 (U), 30 April 1965, p. 25 (TOP SECRET).

³G. R. Thompson, U.S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969 (CONFIDENTIAL), Introduction; CINCPAC, Command History 1964 (Annex A USMACV) (U), p. 173.

⁴Thompson, G. R., U.S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969, p. 1-13 (CONFIDENTIAL); USARPAC, History of the U.S. Army Buildup and Operations in the Republic of Vietnam (RVN) 1 February to 31 December 1963 (U), 11 March 1964, p. 222 (TOP SECRET).

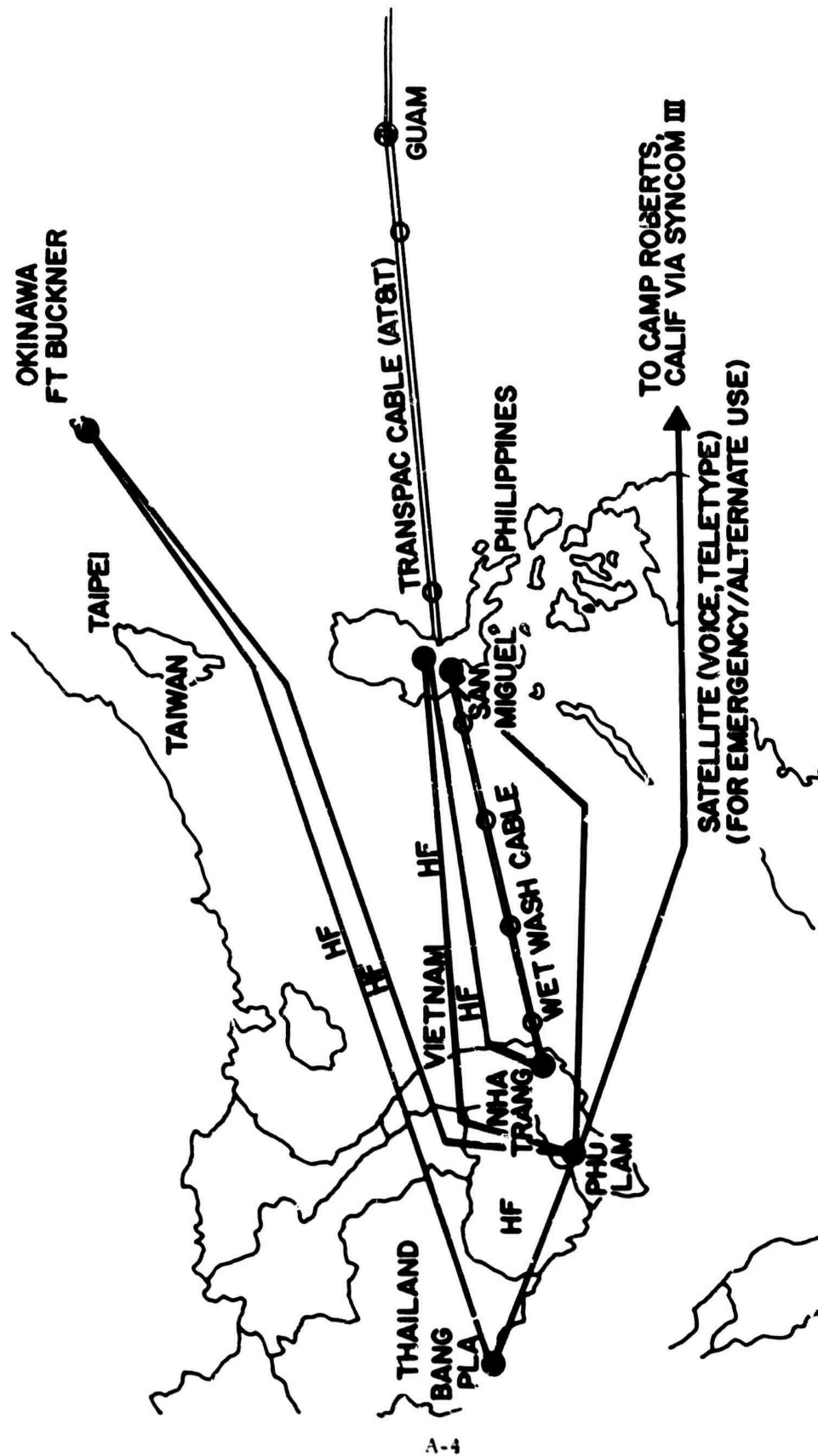


FIGURE A-1. MAJOR COMMUNICATION LINKS INTO VIETNAM - 1 JANUARY 1965

Source: G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950 - 1967 (U), Draft, 22 May 1969, Chart 3 (CONFIDENTIAL)

Facility, Futema, Okinawa, and the 1st Marine Aircraft Wing (MAW), Japan; and one HF Radio Teletype (RATT) circuit to Naval Communications Station, the Philippines. The voice circuit to Futema provided the primary logistics and administrative link to the Marine Wing support organization.

b. WET WASH Cable. A submarine cable to the Philippines was completed on 31 December 1964 to provide better communications to the east. This system, called WET WASH, consisted of a coaxial submarine cable with a 60-voice channel capacity from Nha Trang, RVN, to San Miguel, the Philippines. At the Philippine end, it could be connected to the TRANSPAC cable for circuits to Guam, Midway, Hawaii, and the CONUS. At Nha Trang it was connected to a 60-channel AN/MRC-85 10-kw tropospheric scatter radio (tropo) link to Phu Lam.⁵ (See Figure A-1.)

c. Extensions to Okinawa. The completion of the WET WASH cable system did not provide an alternate route to the HF link to Okinawa. A second tropo link had been projected to provide relief for the Phu Lam - Fort Buckner, Okinawa, HF system. It would link the Philippines to Taiwan where another tropo link would carry circuits to Okinawa. However, the Philippine terminal was being relocated during the winter, 1964-1965; therefore, relief for the HF link was not available.⁶

d. Bangkok Links. Efforts were made in 1963 and 1964 to provide a better communications link from Saigon to Bangkok, Thailand, by means of a direct tropo link. Because of technical considerations, this link was not operational at the end of 1964, and the terminals were being relocated inside Vietnam and Thailand for better propagation.⁷ Therefore, tropo circuits from Saigon to Bangkok could only be obtained by using the BACK PORCH system (see paragraph 4a below) going to Nha Trang, Pleiku, and then to Ubon.

e. Satellite. Limited service was established by the SYNCOM satellite system during August 1964. This system provided 24 hour per day emergency operational communications capability between Saigon and California, using a Mark IV (I) terminal at Saigon. This emergency system used SYNCOM II and SYNCOM III, as it became available in late 1964,⁸ and provided one voice and one teletype circuit.⁹

f. Common-User Facilities. By the end of 1964, communications services for out-of-country common-user traffic were provided by the Phu Lam Facility, located on the outskirts of Saigon. This contained the Joint Overseas Switchboard (JOSS) that provided common-user voice entry into Vietnam and a major torn-tape relay that had been established on 7 January 1964.¹⁰ Although a manual data relay network existed in the Pacific area in 1964, Phu Lam operated as a terminal and not as a relay.¹¹ (See Figure A-2.)

4. COMMUNICATION LINKS INSIDE VIETNAM. Communications inside Vietnam were almost nonexistent at the beginning of the U.S. effort. To provide an initial capability to U.S. elements

⁵Defense Communications Agency, Annual Report of the Director for the Period 1 July 1964 - 30 June 1965 (U), 12 August 1965, p. V, 13 (SECRET).

⁶Defense Communications Agency, 1964 Commanders' Conference Report (U), undated, p. 42 (CONFIDENTIAL).

⁷Defense Communications Agency, Annual Report of the Director for the Period 1 July 1964 - 30 June 1965 (U), 12 August 1965, p. 14 (SECRET). Defense Communications Agency, 1964 Commanders' Conference Report (U), undated, p. 42 (CONFIDENTIAL).

⁸Defense Communications Agency, Annual Report of the Director for the Period 1 July 1964 - 30 June 1965 (U), 12 August 1965, pp. 24-25 (SECRET).

⁹Defense Communications Agency, 1964 Commanders' Conference Report (U), undated, p. 39 (CONFIDENTIAL).

¹⁰G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969, p. 35 (CONFIDENTIAL).

¹¹Defense Communications Agency, 1964 Commanders' Conference Report (U), undated, p. 39 (CONFIDENTIAL).

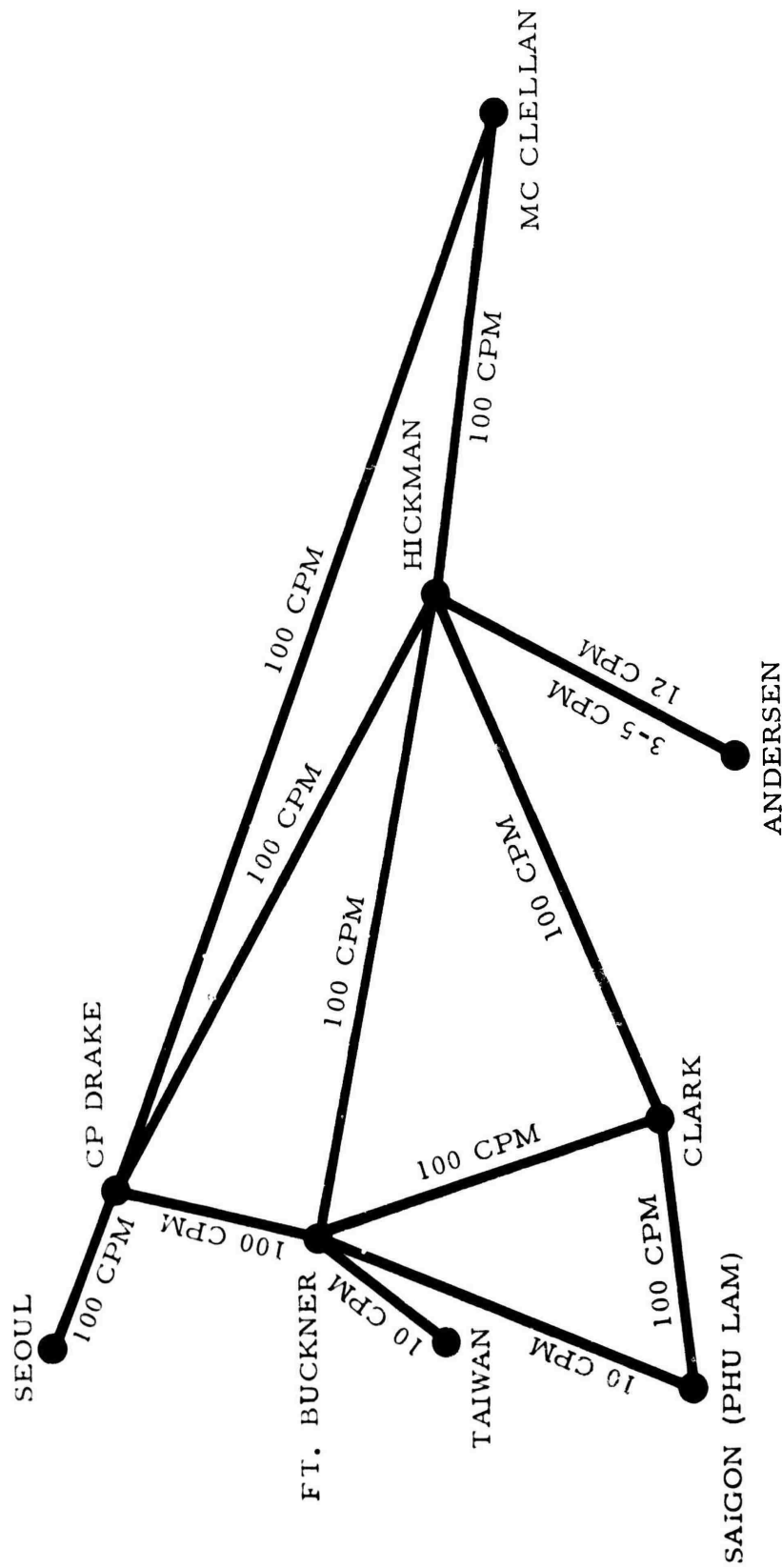


FIGURE A-2. COMMON-USER DATA NETWORK PACIFIC - 1 JANUARY 1965

Source: Defense Communications Agency, 1964 Commanders' Conference Report (U), Undated, p. 55 (CONFIDENTIAL).

working with local military forces, skeletal HF radio nets were set up to maintain contact with the military advisor detachments. These nets included both radio-teletype, using AN/GRC-26s, and voice, using commercial equipment.¹² Because of the extremely limited communications facilities in Vietnam, two different requirements were present for long-haul multichannel military systems. The first was for a basic "backbone" system; the second was for mobile extensions.

a. Backbone Links. To provide a basic backbone that would provide high-quality telephone service and many circuits for both military and civil government users, the Secretary of Defense in 1962 authorized installation of a multimillion dollar tropo radio system known as BACK PORCH. This system was built by the Air Force at a cost of \$14 million using 72-channel, 10-kw AN/MRC-85 equipment capable of transmitting and receiving over single hops up to 200 miles. This system was completed in October of 1962.¹³ (See Figure A-3.)

b. Tactical Extensions. To provide mobile extensions to the BACK PORCH system, the Army deployed 14 AN/TRC-90 tactical troposcatter (tropo) radio sets to Vietnam in 1962. These provided 24 voice channel links. (See Figure A-4.) In addition to tactical tropo, tactical VHF and microwave were also used to connect military circuits to the BACK PORCH system.¹⁴

c. Commercial Systems. In addition to the above, a commercial microwave system, known as SOUTHERN TOLL, extending into the delta region, was completed during 1964. This system, built with Agency for International Development (AID) funds, connected Saigon to My Tho, Vinh Long, Can Tho, Soc Trang, Long Xuyen and Rach Gia.¹⁵ (See Figure A-5.)

5. FLEET COMMUNICATIONS. In the Vietnam theater-of-operations, the U.S. Navy operated the customary fleet broadcast, ship-to-ship and ship-to-shore communications, for units of the Seventh Fleet. Traffic destined for fleet units was passed by means of the fleet broadcast that all ships were required to copy. This broadcast was keyed by Naval Communications Stations that covered designated ocean areas. Naval ships at sea passed their outgoing traffic to the nearest Naval Communications Station (NAVCOMMSTA), which was responsible for relaying it via the Naval Communications System, DCS circuitry, or other means available. As of 1 January 1965, NAVCOMMSTA Philippines, Guam, and Japan were principally involved in communications for the Seventh Fleet.

6. EVALUATION OF COMMUNICATIONS STATUS 1 JANUARY 1965. The primitive environment and austere conditions under which communications were installed prior to 1965 created substantial communications problems.

a. Out-of-Country

(1) Major Reliance on Submarine Cable. The major communications capability to the Philippines (and from there via the TRANSPAC submarine cable to Guam, Japan, Hawaii, and the CONUS) was provided by the WET WASH cable system. Completion of the WET WASH cable on 31 December 1964 and its connection to the TRANSPAC cable had provided major relief for poor out-of-country communications, thereby resulting in a reduction in the traffic

¹²G. R. Thompson, U.S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969, pp. 3, 14 (CONFIDENTIAL); CINCPAC, Command History 1965 (Annex A USMACV) (U), 2 May 1966, p. 378 (TOP SECRET).

¹³G. R. Thompson, U.S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969, pp. 10-11 (CONFIDENTIAL); Defense Communications Agency, Memorandum for the Director, Telecommunications Policy (Installations and Logistics), subject: Fact Sheet for DCA IWCS Briefing, 8 May 1968, 7 May 1968, Chart 1.

¹⁴USARPAC, History of the U.S. Army Buildup and Operations in the Republic of Vietnam (RVN) 1 January 1961 to 31 January 1963 (U), 18 November 1963, p. 162 (TOP SECRET); G. R. Thompson, U.S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969, pp. 10-11, 13 (CONFIDENTIAL).

¹⁵CINCPAC, Command History 1965 (Annex A USMACV) (U), 2 May 1966, p. 378 (TOP SECRET).

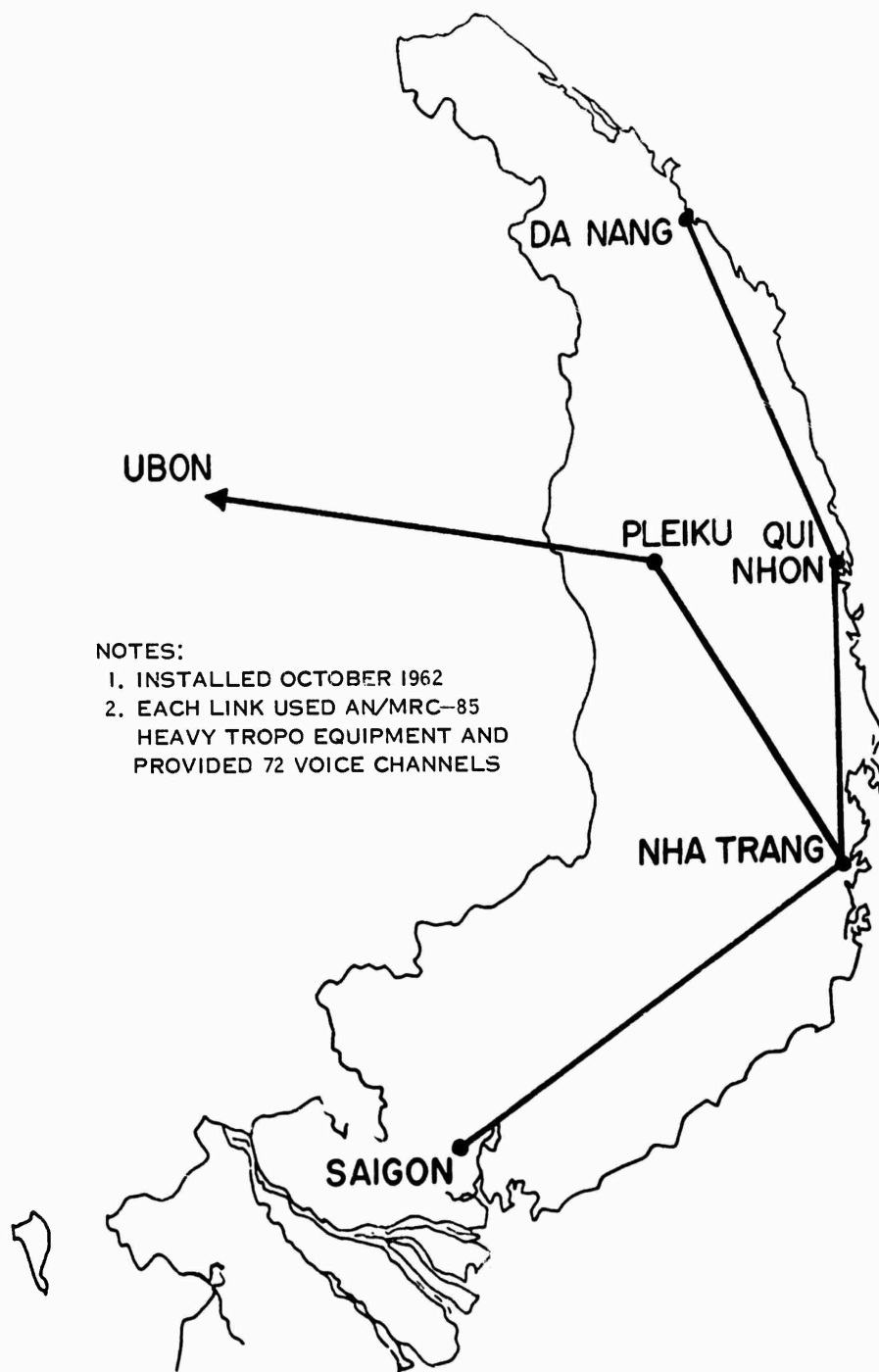


FIGURE A-3. BACK PORCH SYSTEM - 1 JANUARY 1965

Sources: USARPAC, History of the U. S. Army Buildup and Operations in the Republic of Vietnam (RVN), 1 January 1961 to 31 January 1963 (U), 18 November 1968, pp. 161-162. (TOP SECRET).

CINCPAC, Command History 1965 (Annex A USMACV) (U), 22 May 1966, p. 377 (TOP SECRET).

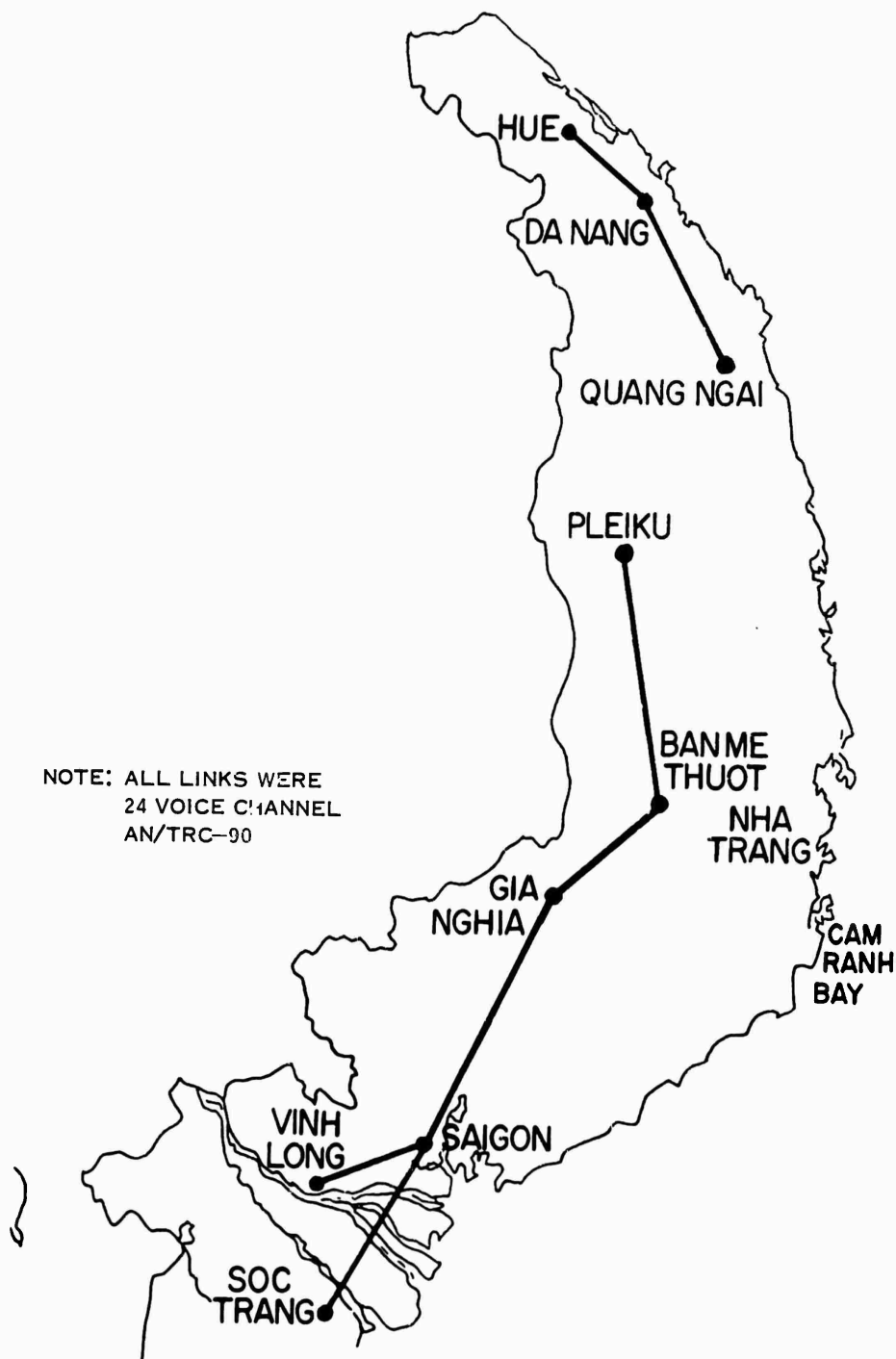


FIGURE A-4. TACTICAL TROPO NETWORKS - DECEMBER 1964

Sources: USARPAC, History of the U. S. Army Buildup and Operations in the Republic of Vietnam (RVN), 1 January 1961 to 31 January 1963 (U), 18 November 1968, pp. 161-162 (TOP SECRET).

G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969, pp. 10, 11, and 13 (CONFIDENTIAL).



FIGURE A-5. SOUTHERN TOLL COMMERCIAL COMMUNICATIONS SYSTEM -
1 JANUARY 1965

Source: CINCPAC, Command History 1965 (Annex A USMACV) (C), 2 May 1966, p. 378 (TOP SECRET).

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backlog in the Pacific area from 1158 hours (December 1964) to 20 hours (February 1965).¹⁶ These cables were reliable and provided high quality circuits, but were subject to being cut. If either cable was cut, the only paths to the east were by satellite and HF.

(2) Satellite Limitations. The satellite system could provide emergency operational communications, but its ability to replace the WET WASH cable was extremely limited; the WET WASH cable could provide 60 voice channels on a full-time basis, whereas, the satellite system could provide only one voice and one teletype channel, and these only on a part-time basis. The SYNCOM satellite program was being supported at the Saigon end with an experimental model terminal. An emergency capability from Saigon to California had been provided on 24 August 1964 using SYNCOM II and which was further supported using SYNCOM III on 14 September 1964; however, the major use of the satellite circuits was for engineering and operational test purposes.¹⁷ In addition, significant technical problems were associated with its operational use and, owing to an inherent time delay for parity checks, maximum data speed on satellite circuits was limited to 50 cards per minute.¹⁸

(3) HF Deficiencies. The HF systems providing out-of-country-circuits were substandard, owing primarily to the lack of clear frequencies in this area of the world.¹⁹ This was reflected in the quality of service provided to users of communications prior to 1 January 1965.

(a) Voice. Until 31 December 1964, the overseas voice service to Vietnam was provided through three HF voice channels to the Philippines and a similar system to Okinawa. This service was basically unsatisfactory. "Placing an overseas call," the Phu Lam station history recounts, "required about 10% patience and 90% luck." The station logs for the year 1963 describes conditions from day to day on the overseas voice circuits. The entries read consistently "out" or "out to fair," "poor to fair," and "out all day." On one occasion, covering a 3-day period in July 1963, the station log records that only nine radio-telephone calls were completed with the Okinawa station, and 47 calls with the station in the Philippines (Clark AB).²⁰

(b) Teletype. Overseas teletype traffic to Vietnam reflected the substandard HF circuits in message backlog figures. As noted above, these backlogs began to clear when the WET WASH cable was placed in service.

(c) Substandard Communications to Okinawa. Communications to Okinawa, a major logistical base, were substandard. The circuits provided by HF were not replaced by the WET WASH cable due to the problems encountered in extending circuits from the Philippines to Okinawa. (See paragraph 3c above.)

b. In-Country and Local. The in-country long-lines problems and the local problems each compounded the other.

¹⁶Defense Communications Agency, Annual Report of the Director for the Period 1 July 1964 - 30 June 1965 (U), 12 August 1965, pp. V, 12, 14 (SECRET).

¹⁷Ibid., pp. 24-27.

¹⁸Defense Communications Agency, 1964 Commanders' Conference Report (U), undated, pp. 39, 41-42, 50, 330-331 (CONFIDENTIAL).

¹⁹Ibid., p. 40; CINCPAC, Command History 1964 (Annex A USMACV) (U), undated, p. 351 (TOP SECRET); USARPAC, History of the U. S. Army Buildup and Operations in the Republic of Vietnam (RVN)

1 February to 31 December 1963 (U), 11 March 1964, pp. 299-331 (TOP SECRET).

²⁰G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969, p. 24 (CONFIDENTIAL).

(1) Basic RVN Long-Lines Inadequacies. The basic long-lines system in RVN, BACK PORCH, although providing the major communications links in RVN, had substantial problems:

(a) The sites had been chosen for security reasons and not for propagation characteristics. As a result, the links did not meet DCS standards.

(b) The technical control facilities were inadequate to provide supervision over the circuits.²¹ As a result, troubleshooting procedures could not be adequately implemented and circuit restoration actions were severely hindered.

(c) There was a shortage of channels from Saigon to Nha Trang, thus restricting access to the north.²²

(d) There was a significant degree of vulnerability to enemy action at Nha Trang, where the links to Saigon, Qui Nhon, Da Nang, and Pleiku all came together.

(2) Mixture of Communication Equipments. The mixture of tactical and fixed-plant communication equipment caused technical difficulties. These difficulties included substantial incompatibility problems (e.g., differences in levels and ringing frequencies,) that caused additional degradation as circuits were extended from one link to another.

(a) The tactical equipment, built to be rapidly emplaced and to provide basic voice communications, was not designed to provide the low noise levels required by the DCS.²³

(b) The fixed-plant links, although capable of providing high-quality channels, could not change circuit configurations rapidly enough to meet a tactical user's requirements without incurring degradation.²⁴

(3) Overloaded Communication Facilities. Overloaded communications facilities resulted in degraded service to users.

²¹Ibid., pp. 15-16.

²²CINCPAC, Command History 1964 (Annex A USMACV) (U), undated, p. 178 (TOP SECRET); G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), Draft, 22 May 1969, p. 19 (CONFIDENTIAL).

²³Consider, for example, the problems created by differences in grounding requirements. An AN/TRC-24 system is normally grounded by driving a 6-foot rod into the earth. This will provide, typically, a 50-ohm resistance path to the earth, which is sufficient for the tactical user. However, a long series of such connections established through one circuit extending over a number of such links will result in an extremely noisy circuit. If such a circuit is coupled into the long-haul network from a switchboard, the noise built up by that circuit can spill over into adjacent channels and cause their degradation. The typical fixed-plant ground path avoids this problem by providing a resistance path to ground of less than 5 ohms. However, it may take 2 or 3 weeks of detailed engineering effort to design and install such a ground. By that time, the tactical equipment has been moved at least once. Similar problems exist in the use of "idleline terminations" for tactical switchboard lines, high levels used in tactical system for ringing signals, and type of technical control facilities used. A fixed-plant quality system requires an amount of emplacement time that is at direct variance with the tactical user's requirement for immediate communications; therefore, the majority of items required to provide a fixed-plant quality system are not a part of a tactical system.

²⁴These links, employing a variety of soldered connections for conditioned circuits, require time for the circuits to be engineered and tested. This averages 4 days for the majority of circuits. If this test period is accelerated or bypassed, there is substantial circuit degradation and additional problems arise at a later time.

(a) The facilities of the DCS station at Clark AB, the gateway to SE Asia, were outdated and saturated. Project SPEED QUEEN had been initiated to provide relief but the tape relay portion would not be completed until 25 February 1966.^{25, 26}

(b) The capacity to handle overloads at the major tape relay in RVN, Phu Lam, did not exist. For example, during the August 1964 crisis in the Tonkin Gulf, Phu Lam handled a monthly total of 3,265 flash messages, an average of over 105 flash messages daily, with a peak of 258 flash messages in 1 day. As the Chief, DCA-PAC, reported: "Lower precedence messages didn't have a chance."²⁷

(4) Inadequate Telephone Service. The military telephone system inside Vietnam was a hodgepodge of duplicating trunks, poor circuitry, and overlapping responsibilities.²⁸ An effective long-distance voice-switching service did not exist.

(5) Lack of Planning. Although all of the above problems had been previously identified, the planning required to solve these problems had not been initiated prior to June 1964.

(a) The DCA mid-range plan of 1962, as approved by the Secretary of Defense, assigned responsibility for the DCS in Vietnam to the U.S. Army.²⁹ This assignment had been further supplemented in 1963 by an Army - Air Force agreement by which the Army was to provide long-haul common-user service, whereas the Air Force provided local service at five specified locations in Vietnam. However, the assumption had been made that the Vietcong would be eliminated in South Vietnam by December 1965. As a result, the communications planning efforts were oriented towards turning the existing communications over to the RVN. The June 1963 COMMUSMACV Comprehensive Plan for Telecommunications called for phasing out the U.S. 39th Signal Battalion. This plan, modified by CINCPAC, was approved by the Joint Chiefs of Staff. Up to June 1964, when events indicated the questionable validity of the above assumption, all planning efforts had been directed towards phasing out the U.S. communications effort in Vietnam as quickly as possible. The majority of the tactical communications equipment was to be turned over immediately to the RVN armed forces, and operation of the BACK PORCH system was to be assumed by the RVN as quickly as their capability could be developed.³⁰

²⁵Defense Communications Agency - Southeast Asia Region General Information Booklet (U), 1 July 1966, as amended by two changes, dated 1 February 1967 and 3 April 1967, p. 3 - 1 (CONFIDENTIAL); Defense Communications Agency, 1964 Commanders' Conference Report (U), undated, p. 42 (CONFIDENTIAL).

²⁶Project SPEED QUEEN was initiated to modernize and expand the DCS facilities in the Philippines and to improve communications to SE Asia. SPEED QUEEN was part of the Philippines Consolidation Improvement Program and provided solid state equipment to modernize the technical control facilities, transmitters, receivers, antennas, and intersite facilities. The first program was initiated on 3 April 1964, and the project was completed on 3 December 1967. Total program cost was \$7,486,000. (Data supplied by AFCS, 17 June 1969.)

²⁷Defense Communications Agency, 1964 Commanders' Conference Report (U), undated, p. 40 (CONFIDENTIAL).

²⁸USARPAC, History of U.S. Army Operations in Southeast Asia, 1 January 1964 to 31 December 1964 (U), 30 April 1965, p. 162 (TOP SECRET).

²⁹Defense Communications Agency, Memorandum, subject: DCA Mid-Range Plan Defense Communications System 1962, 18 January 1963 (SECRET).

³⁰CINCPAC, Command History 1964 (Annex A USMACV) (U), undated, p. 351 (TOP SECRET); USARPAC, History of U.S. Army Operations in Southeast Asia, 1 January 1964 to 31 December 1964 (U), 30 April 1965, pp. 158-161, 163 (TOP SECRET); USARPAC, History of the U.S. Army Buildup and Operations in the Republic of Vietnam (RVN) 1 February to 31 December 1963 (U), 11 March 1964, pp. 24-35, 220 (TOP SECRET); CINCPAC, Command History 1965 (Annex A USMACV) (U), 13 May 1966, p. 104 (TOP SECRET).

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(b) By 1 January 1965, MACV had identified to CINCPAC two major communications areas in which serious deficiencies existed. These were the in-country telephone network and the long-line circuits in-country. Specific requirements of logistical elements for communications were not uniquely identified. The identification of requirements by MACV to CINCPAC was on an overall basis without any substantial separation of needs as to function, e.g., logistical, administrative, and operational.

c. Fleet Communications. Significant problems existed on 1 January 1965 that resulted in recurring backlogs of message traffic to fleet units. These included saturated DCS channels between WESTPAC, NAVCOMMSTAs, and lack of adequate broadcast transmission capacity. The majority of ships were without multichannel broadcast facilities, and on-line ship-shore and ship-ship equipment. Modern radio single sideband equipment with frequency synthesized transmitters and receivers had not been installed in Service Force ships.³¹ In addition, there was a lack of suitable equipment, both afloat and ashore, for the transmission of digital data via HF radio systems.³²

7. **SUMMARY.** Although a basic communications capability existed in SE Asia, its overall effectiveness was significantly limited. Planning actions to resolve the communications problem areas had been initiated in 1964, when it became apparent that the U.S. effort in RVN would not close out in the near future.

³¹CNO OP-441P Memorandum Ser 003725P094, 26 May 1969.

³²OP-942 Memorandum, 8 April 1969, subject: Study of ADP Impact on Naval Communications.

APPENDIX B

BUILDUP OF OUT-OF-COUNTRY LINKS

1. **PURPOSE.** The purpose of this appendix is to provide the background of the buildup of the out-of-country communication links.

2. **GENERAL.** By December 1964, the capability of the communications to Vietnam to support even the existing troop and logistic structures was strained. The major out-of-country circuit congestion was relieved during the period January-February 1965 as the WET WASH cable was fully put into service. With the exception of the circuits to Okinawa, a major off-shore logistical base, the out-of-country HF trunks in Vietnam were used primarily to furnish a backup capability.¹ These existing HF links did not provide the quantity of circuits or the quality of service required. Therefore, the two primary problems of RVN out-of-country logistic communications were to establish sufficient alternate routing capacity to sustain the loss of a major link and to provide a reliable high-quality path to Okinawa.

3. **HIGH-FREQUENCY RADIO.** On 12 April 1966, the Deputy Secretary of Defense approved a program to provide three additional HF backup trunks to the existing links between Nha Trang and Clark, San Miguel, and Guam, using transportable contingency equipment, AN/TSC-18 and AN/TSC-19. Two of the trunks, Nha Trang to the Philippines, were in operation on an interim basis in late November 1966. However, usefulness of these trunks was limited due to lack of adequate real estate, which caused inadequate separation of transmitter and receiver antennas with resultant mutual interference. Upgrading actions for these trunks, as well as activation of the Guam trunk, was delayed pending completion of an antenna field in the vicinity of Cam Ranh Bay. By July 1967, the HF trunks in SE Asia were as shown in Figure B-1.²

4. **SATELLITE.** By August 1967, the alternate routing capabilities of satellites had exceeded those of HF radio described above. Three different satellite programs were used to provide out-of-country communications:

a. **SYNCOM.** The SYNCOM program, transferred to DOD from the National Aeronautics and Space Administration on 1 April 1965,³ completed its experimental test program in March 1966,⁴ and the SYNCOM Satellite Communication System became operational on 1 July 1966. This included deployment of an AN/MS-44 terminal station to Saigon to replace the MARK IV (I).⁵ Beginning 1 July 1967 the SYNCOM System was gradually phased down.⁶ As of

¹Defense Communications Agency - Southeast Asia Mainland Region, Commanders' Report, 1 July 1966 - 1 July 1967 (U), undated, Section II-7 (CONFIDENTIAL).

²Defense Communications Agency, Annual Report of the Director for the Period 1 July 1966 to 30 June 1967 (U), undated, p. 99 (SECRET); Defense Communications Agency - Southeast Asia Mainland Region, Commanders' Report, 1 July 1966 - 1 July 1967 (U), undated, Section II-8 (CONFIDENTIAL).

³Defense Communications Agency, Annual Report of the Director for the Period 1 July 1964 - 30 June 1965 (U), 12 August 1965, p. 25 (SECRET).

⁴Defense Communications Agency, Annual Report of the Director for the Period 1 July 1965 - 30 June 1966 (U), 15 August 1966, p. 77 (SECRET).

⁵Defense Communications Agency, Annual Report of the Director for the Period 1 July 1966 - 30 June 1967 (U), undated, p. 57 (SECRET).

⁶Defense Communications Agency, Annual Report of the Director for the Period 1 July 1967 - 30 June 1968 (U), 14 August 1968, p. 58 (SECRET).

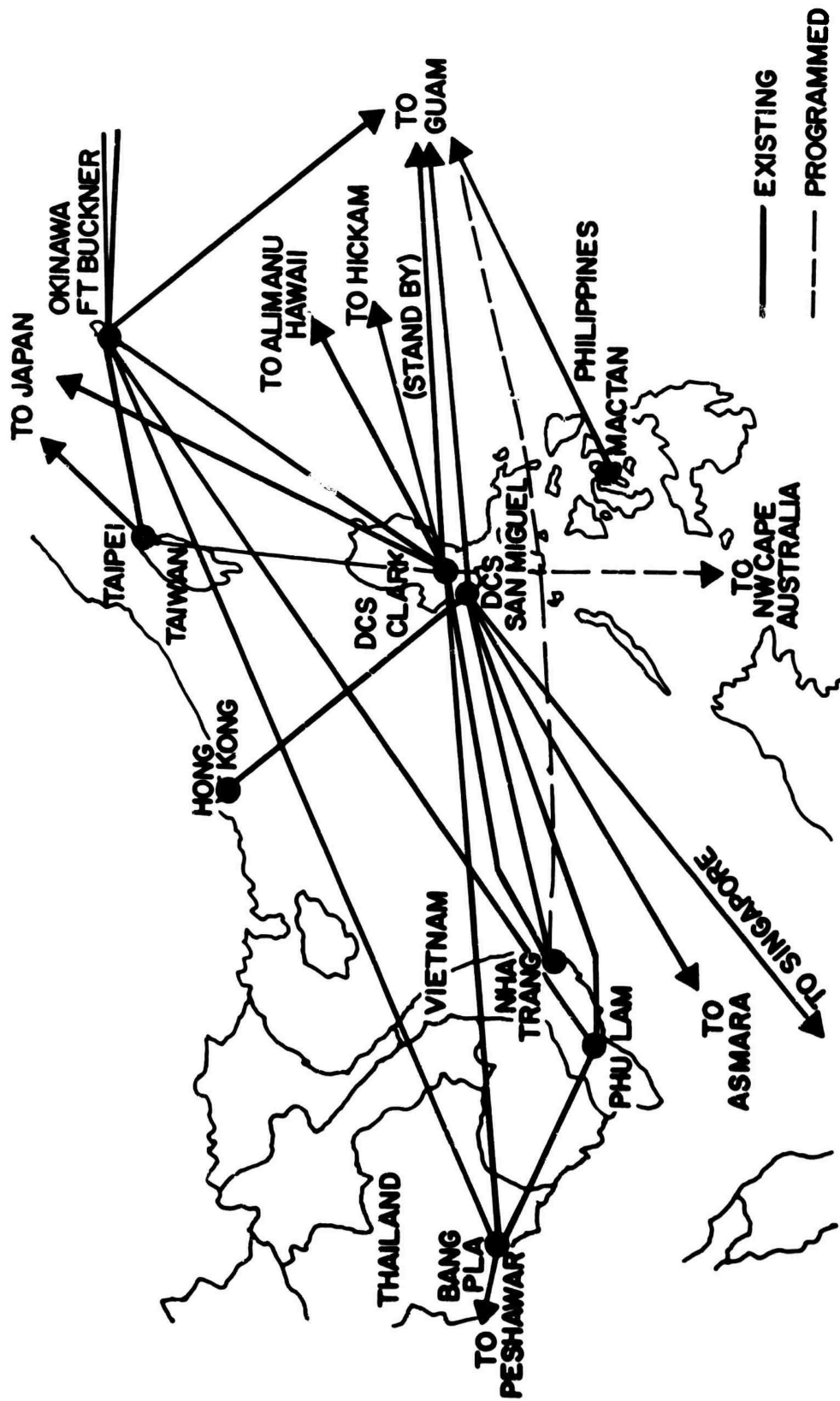


FIGURE B-1. DCS SE ASIA HF TRUNKS - JULY 1967

Source: Defense Communications Agency, Southeast Asia Region General Information Booklet (U), 1 July 1966, as amended by two changes dated 1 February 1967 and 3 April 1967, pp. 2-20 (CONFIDENTIAL).

December 1967, this system no longer provided communications into Vietnam.⁷ During this period of time, SYNCOM had provided one voice and one teletype channel to the east.

b. IDCSP. The Initial Defense Communications Satellite Program (IDCSP) plan to place two AN/MS-46 terminals in Vietnam was approved by the Secretary of Defense on 16 April 1966. This was a diversion of a research and development program effort into an operational theater.⁸ In July 1967, the Pacific portion of the IDCSP, including terminals at Nha Trang and Saigon, became operational. Both terminals in Vietnam initially provided a basic five-voice channel capability,⁹ but by June 1968, these terminals had been modified to provide an 11 tactical voice channel capacity.¹⁰

c. COMSAT. On 16 May 1967, six voice channels were provided from Hawaii over the Communications Satellite Corporation (COMSAT) satellite to a newly activated earth terminal in Thailand. From there, the circuits went to Saigon via the 439L cable interconnect, which was completed between Thailand and Vietnam in May 1967.¹¹ (The details of the 439L cable project are discussed in Appendix C.)

5. BANGKOK-SAIGON TROPO LINK. A tropo link from Saigon to Bangkok had been planned, as early as 1962, as part of the buildup of out-of-country systems.¹² In late 1965, the system was cut to traffic due to operational requirements for additional channels; however, extensive upgrading was necessary during early 1966. At the end of the upgrading, the system operated satisfactorily for voice but was, at times, marginal for teletype.¹³ The system, as it then existed, consisted of a 60-channel microwave link from Phu Lam to Vung Tau, and a 10-kw tropo link, Vung Tau to Green Hill in Thailand. Due to noise considerations, the tropo portion of the system provided only 24 channels.¹⁴ This system could not be used to provide that part of the path from Saigon to Thailand, which used the COMSAT satellite terminal station located in Thailand, to extend circuits to Hawaii.

6. SUBMARINE CABLE BREAK, AUGUST 1967. The ability of the out-of-country links to function in spite of damage to a major link was tested on 25 August 1967 when the undersea cable from the Philippines to Guam was cut. This cut interrupted nine voice channels on which teletype traffic was multiplexed, three data circuits, one facsimile, and 26 voice circuits. All but seven voice circuits were restored in a short time using COMSAT, IDCSP, and SYNCOM satellite circuits as well as the tropo linking the Philippines, Taiwan, Okinawa, and Japan. The remaining seven voice circuits were restored 2 days later using the Guam to Hong Kong

⁷Regional Communications Group, 1st Signal Brigade (STRATCOM) IWCS Orientation, Second Edition, 1 April 1968, p. XVI-1.

⁸Defense Communications Agency, Annual Report of the Director for the Period 1 July 1965 - 30 June 1966 (U) 15 August 1966, pp. 82-88 (SECRET).

⁹Defense Communications Agency, Annual Report of the Director for the Period 1 July 1966 - 30 June 1967 (U), undated, pp. 5, 101, 102 (SECRET); Defense Communications Agency - Southeast Asia Mainland Region, Commanders' Report, 1 July 1966 - 1 July 1967 (U), undated, Sec. II-5 (CONFIDENTIAL). 1st Signal Brigade, Letter, Subject: Operational Report for Quarterly Period Ending 31 July 1967 (U), 14 August 1967, p. 9 (CONFIDENTIAL).

¹⁰Defense Communications Agency, Annual Report of the Director for the Period 1 Jul 1967 - 30 Jun 1968 (U), 14 August 1968 pp. 117, 118 (SECRET).

¹¹Defense Communications Agency, Annual Report of the Director for the Period 1 July 1966 - 30 June 1967 (U), undated, pp. 103, 104 (SECRET).

¹²G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950 - 1967 (U), Draft, 22 May 1969, p. 25 (CONFIDENTIAL).

¹³Defense Communications Agency, Annual Report of the Director for the Period 1 July 1965 - 30 June 1966 (U), 15 August 1966, pp. 4, 14 (SECRET).

¹⁴Regional Communications Group, 1st Signal Brigade (STRATCOM) IWCS Orientation, Second Edition, 1 April 1968, pp. 1-3.

cable, Hong Kong to Taiwan commercial tropo, and thence to the Philippines and Vietnam using military facilities.¹⁵ (The Taiwan-to-Philippine tropo link had been conditionally accepted on 30 April 1966¹⁶ and was used successfully to carry 26 channel AN/FGC-76 voice frequency tele-type group systems when the Philippine-Guam cable was cut.) Thus, although certain problems existed (e. g. , attempts to restore data circuits via satellite could be done only at greatly reduced data rates), the ability of the out-of-country systems to provide alternate routing under adverse conditions had been established.

7. COMMUNICATIONS TO OKINAWA. Throughout the period 1 January 1965 through June 1967, the HF link from Phu Lam to Okinawa was employed to handle the heavy traffic required for the major logistic bases located at Okinawa. This link was basically unsatisfactory for handling data due to technical reasons. For example, in October 1966, use of the HF circuits for transmitting this traffic resulted in about 50 percent of the requisitions requiring correction. Circuits over other communications links (i. e. , via the WET WASH cable to the Philippines and from there to Okinawa by tropo) were not available to replace the HF link circuits due to other essential traffic requirements.¹⁷ Primary reliance was placed on courier runs to Okinawa to deliver cards. A high-quality path for electrical transmission of data traffic to Okinawa was not established until June 1967. At that time the circuit was taken off of the HF link and re-routed to go from Phu Lam to Hawaii to Japan via submarine cable and from Japan to Okinawa by tropo.¹⁸

8. SUMMARY. The two major problems of logistic communications to out-of-country points were attacked on multiple fronts.

a. Alternate routing was established by use of contingency HF equipment, and diversion of research and development satellite programs into operational use. By July 1967 sufficient alternate routing capacity had been established to sustain the impact of loss of a major link.

b. A high-quality path was provided to Okinawa using submarine cable in July 1967.

¹⁵Presentation by Chief DCA - Pacific, to the DCA Commanders' Conference, 5 October 1967, pp. 1-7 (CONFIDENTIAL).

¹⁶Defense Communications Agency, Annual Report of the Director for the Period 1 July 1965 - 30 June 1966 (U), 15 August 1966, p. 108 (SECRET).

¹⁷Department of the Army, Memorandum for the Secretary of Defense, subject: Review of Army Logistics System in Support of Vietnam (U), 7 October 1966 (SECRET).

¹⁸United States Marine Corps Headquarters, Fleet Marine Force Pacific, Letter, subject: Joint Logistics Review Board Requirement, 21 June 1969, pp. 9, 11; 1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 31 July 1967 (U), 14 August 1967, p. 20 (CONFIDENTIAL).

APPENDIX C

BUILDUP OF RVN LONG LINES

1. **PURPOSE.** The purpose of this appendix is to provide the background of the buildup of the long lines capability in Vietnam.

2. **INITIAL PLANNING ACTIONS.** In view of the limited capability of the basic backbone system (see Appendix A) in October 1964, Commander in Chief Pacific (CINCPAC) validated to the Joint Chiefs of Staff the requirements for what became known as Phase I of the Integrated Wideband Communication System (IWCS). These requirements were not intended to support a large troop buildup, but only to provide the communications for up to 40,000 U.S. troops in-country, primarily advisors and helicopter units. The objectives of Phase I were to upgrade the existing BACK PORCH AN/MRC-85 links, to provide adequate technical control facilities at the terminal sites, to replace the inadequate tactical equipment in the Saigon area with fixed-plant high reliability high-capacity links, to provide an alternate route northward to the middle of the country and to provide additional communications channels from Saigon to the north and from the Da Nang area to Phu Bai.¹

3. **USE OF CONTINGENCY ASSETS.** With the deployment of substantial quantities of troops, the lack of in-country long-haul circuitry became critical. Planning had been initiated to provide fixed-plant high-quality links; however, these would not solve the immediate problem in a timely manner. To provide immediate expansion of the existing BACK PORCH facilities, available Air Force heavy tropo equipment was deployed during 1965 as follows.²

<u>Link</u>	<u>Equipment</u>	<u>Link Channel Capacity</u>
Pleiku - Da Nang	AN/MRC-85	72
Vung Tau - Cam Ranh Bay	AN/MRC-98	60
Ubon - Da Nang	AN/MRC-98	24

To supplement these heavy tropo systems, six additional Army AN/TRC-90 tropo terminals and teams were deployed in March 1965. These were used to bring the Saigon-Pleiku link, previously established at 24 channels, to 48 voice channels, and to provide an extension of the long lines system from Da Nang to Chu Lai.^{3,4} To these deployment were added microwave (AN/TRC-29) and additional VHF (AN/TRC-24) links. The results of these efforts are shown in Figures C-1 and C-2.⁵ Further extensive deployment of tactical radio equipment, tropo, microwave,

¹Defense Communications Agency, Memorandum for the Director, Telecommunications Policy (Installations and Logistics), subject: Fact Sheet for DCA IWCS Briefing, 8 May 1968, 7 May 1968, p. 1.

²CINCPAC, Command History 1965 (Annex A USMACV) (U), 2 May 1966 pp. 386-387 (TOP SECRET).

³Ibid, p. 386; United States Army Strategic Communications Command, History of the U.S. Army Strategic Communications Command, FY 1965 (U), undated, p. 42 (CONFIDENTIAL); Commander in Chief, United States Army, Pacific Message to Defense Agency, Cite GB SO 5239, 13 March 1965, subject: BACK PORCH Upgrading and Restoral (U) (CONFIDENTIAL).

⁴The rapidity with which these assets were deployed is shown by the fact that the AN/TRC-90s were requested by CINCUSARPAC on 13 March 1965 and were shipped by air complete with trained operating teams from Travis AFB on 24 March 1965.

⁵CINCPAC, Command History 1965 (Annex A USMACV) (U), 2 May 1966 p. 400 (TOP SECRET).

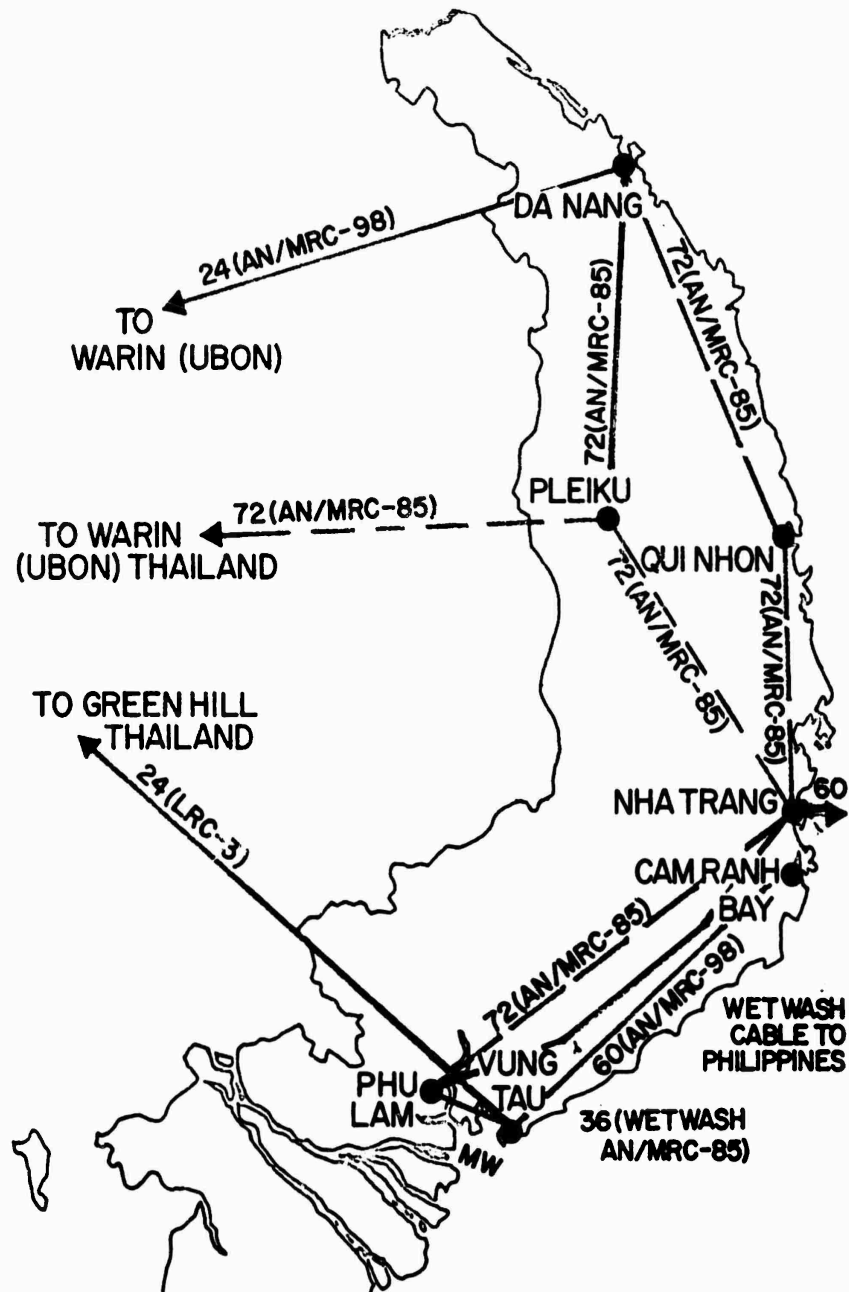


FIGURE C-1. FIXED-PLANT TYPE LINKS IN VIETNAM - 31 DECEMBER 1965

Source: CINCPAC, Command History 1965 (Annex A USMACV) (U) 2 May 1966, p. 386 (TOP SECRET).

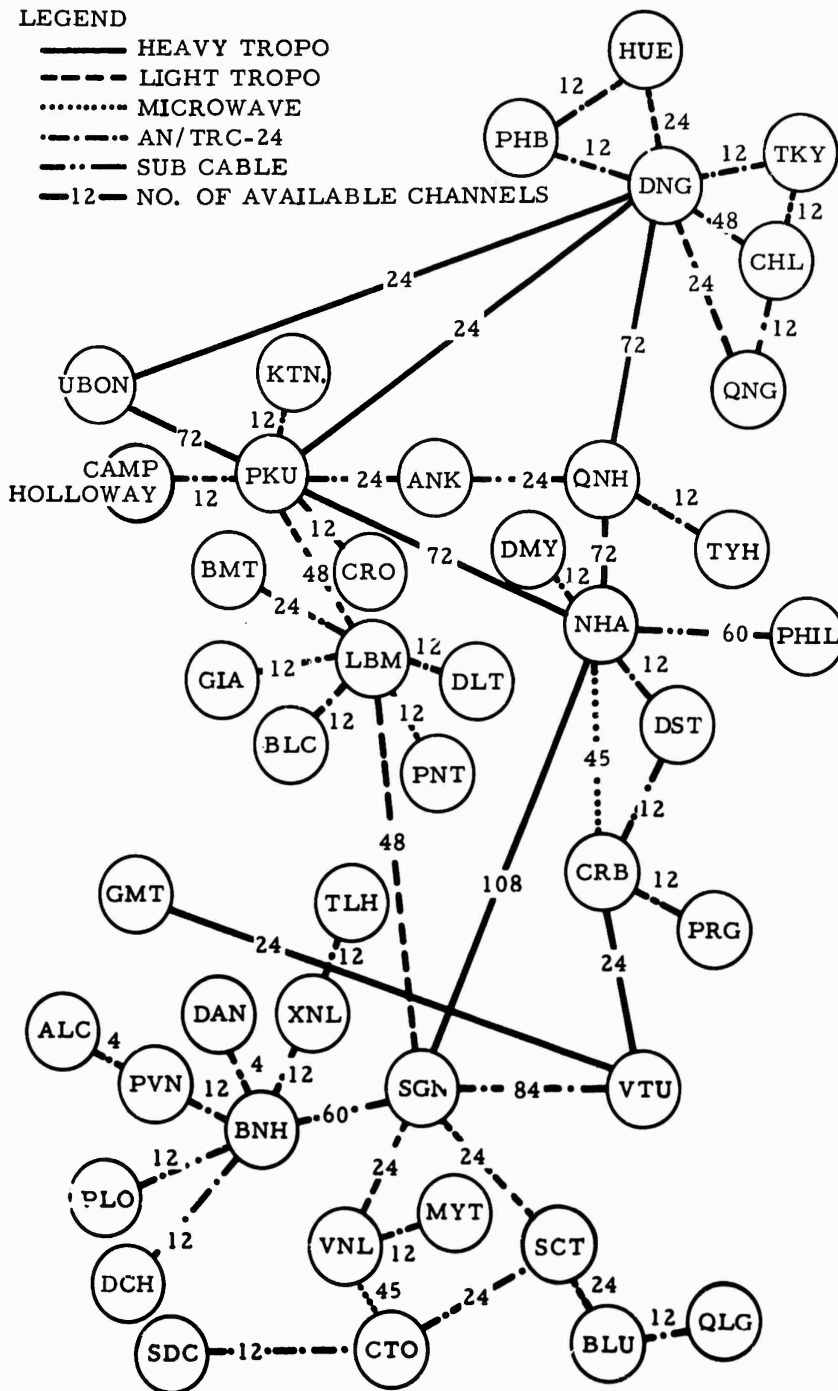
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LEGEND

- HEAVY TROPO
- - - LIGHT TROPO
- MICROWAVE
- - - - AN/TRC-24
- · - - SUB CABLE
- 12— NO. OF AVAILABLE CHANNELS

KEY

- ALC-AN LOC
- ANK-AN KHE
- BLC-BAU LOC
- BLU-BAC LIEU
- BMT-BAN ME THUOT
- BNH-BIEN HOA
- CHL-CHU LAI
- CRB-CAM RANH BAY
- CRO-CHEO REO
- CTO-CAN THO
- DAN-DIAN
- DBT-DONG BA THIN
- DCH-DUC HOA
- DMY-DUC MY
- DLT-DALAT
- DNG-DA NANG
- GIA-GIA NGHAI
- GMT-GREEN MOUNTAIN
- HUE-HUE
- KTM-KONTUM
- LBM-LANG BIEN MOUNTAIN
- MYT-MY THO
- NHA-NHA TRANG
- PHB-PHU BAI
- PHIL-PHILIPPINE ISLAND
- PKU-PLEIKU
- PLO-PHU LOI
- PNT-PHAN THIET
- PRG-PHAN RANG
- PVN-PHUOC VINH
- QLG-QUANG LONG
- QNG -QUANG NGAI
- QNH-QUI NHON
- SCT-SOC TRANG
- SDC-SADEC
- SGN-SAIGON
- TKY-TAM KY
- TLH-TANH LINH
- TYH-TUY HOA
- UBON-UBON
- VNL-VINH LONG
- VTU-VUNG TAU
- XML-XUAN LOC



NOTES:

1. THE NUMBER OF AVAILABLE CHANNELS MAY BE LESS THAN THE LINK CAPABILITY DUE TO NOISE, INTERCONNECTION, OR TRAFFIC CONSIDERATIONS.
2. THIS DOES NOT SHOW ALL THE INTERCONNECTIONS AND EXTENSIONS TO THIS SYSTEM: E. G. THE SAIGON INTER-CITY NETWORK, BUT ONLY THE MAJOR LINKS.

FIGURE C-2. LONG LINES SYSTEM IN RVN - DECEMBER 1965

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and VHF was made during 1966 and 1967. By December 1967, these provided Defense Communications System (DCS) communications links in RVN as follows.⁶

<u>Tropo</u>	<u>Microwave</u>	<u>VHF</u>
22	17	67

As a further effort, additional deployments were made to provide area communications. By mid-1967, these included over 130 multichannel tactical radio links.⁷

4. ADDITIONAL IWCS ACTIONS. As further troop buildup plans became known, additional fixed-plant communication requirements were developed into what became Phase II and Phase III of the Integrated Wideband Communication System (IWCS). Phase II was designed to support a troop strength of 200,000. Phase III was designed to support a troop strength of 400,000. The sequence of actions involved in Phases I, II, and III, of the IWCS is shown in Table C-1. The amount of time (in months) required to accomplish various actions, as shown in Table C-1, is as follows.

	<u>Phase I</u>	<u>Phase II</u>	<u>Phase III</u>
From Initiation of Requirements to DOD Funding Approval	12	3	11
From Award/Amendment of Contract to First Link Operational	15	13	13
From First Link Operational to Completion of Work	13	11	13

The increase in channel capacity by implementation of these phases is shown in Figures C-3, C-4, and C-5.⁸ The scope of the IWCS effort, as of 1 May 1969, was as follows:⁹

Geography	- 59 sites, 570,000 circuit miles
Buildings	- 109, with 282,000 sq. ft. floor space
Power	- 44 plants, 24,240 KW
Contract Cost	- \$166,000,000
Material	- \$70,000,000 16,500 tons

5. 439L COASTAL CABLE PROJECT. A second major long-haul system was built, in addition to the IWCS, to provide circuits along the coast of Vietnam and to Thailand via submarine coastal cable; this system was called the 439L project. In April 1965, COMUSMACV had

⁶USARPAC, Communications Evaluation in Southeast Asia (COMSEA) (U), 17 June 1969, p. C-41 (CONFIDENTIAL).

⁷Ibid., p. C-93.

⁸Defense Communications Agency, Memorandum for the Director, Telecommunications (Policy Installations and Logistics), subject: Fact Sheet for DCA IWCS Briefing, 8 May 1968, 7 May 1968; Defense Communications Agency (DCA-313), Memorandum for General Besson, subject: Communications Problem Areas (U), 13 June 1969, (CONFIDENTIAL).

⁹Page Communications, Inc., Subject: IWCS, 1 May 1969.

TABLE C-1

TIME-PHASED SEQUENCE OF IWCS ACTIONS

<u>Item No.</u>	<u>Phase I Action</u>	<u>Phase II</u>	<u>Phase III</u>	<u>Date</u>
1	COMUSMACV forwarded need for additional communications with IOC date of Dec. 65			Aug. 64
2	CINCPAC forwarded to JCS, validating requirements and IOC			Oct. 64
3	DCA prepared and forwarded system plan to JCS			Dec. 64
4	DOD approved concept and requested Army prepare TPO			Apr. 65
5	Army forwarded TPO to DOD with IOC date of Mar. 66			Jun. 65
6	DOD approved TPO			Aug. 65
7	Army awarded letter contract			Sept. 65
8		COMUSMACV forwarded need for additional communications with IOC date of Oct. 66		Oct. 65
9		CINCPAC forwarded to JCS, validating requirements and IOC		Dec. 65
10		Army submitted addendum to TPO to DOD with IOC date of Oct. 66		Dec. 65
11			COMUSMACV forwarded for need for additional communications with IOC Dec. 65	Dec. 65
12		DOD approved amendment to TPO		Jan. 66
13		Army amended existing contract		Feb. 66

TABLE C-1

TIME-PHASED SEQUENCE OF IWCS ACTIONS (Continued)

<u>Item No.</u>	<u>Phase I</u>	<u>Phase II</u>	<u>Phase III</u>	<u>Date</u>
14			CINCPAC forwarded to JCS, validating requirements and IOC	Mar. 66
15			Army forwarded addendum to TPO to DOD with IOC date of Apr. 67	Mar. 66
16	Army definitized contract for Phases I and II	Army definitized contract for Phases I and II		May 66
17			DOD approved amendment to TOP	Aug. 66
18			Army amended contract	Nov. 66
19	First link operational			Dec. 66
20			Army (USACSA) identified funding deficit	Feb. 67
21		First link operational	Working group of alcon met Wash. to review contractor tech. proposal	Mar. 67
22			DCA published recommended changes of working group and obtained concurrences of alcon hq.	Apr. - May 67
23			Army forwarded to ASD (I&L) request for additional \$50.5 million	Aug. 67
24			ASD (I&L) returned Army request for additional information	Sep. 67
25			Army resubmitted request for \$50.5 mil.	Oct. 67
26			DOD approved additional \$50.0 million (Army programming)	Nov. 67
27			First link operational	Dec. 67

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TABLE C-1

TIME-PHASED SEQUENCE OF IWCS ACTIONS (Continued)

Item No.	Phase I	Phase II	Phase III	Date
28	Last link operational		Army definitized Phase III contract	Jan. 68
29		Last link operational		Feb. 68
30			Last link operational	Jan. 69

Sources: Defense Communications Agency, Memorandum for the Director, Telecommunications Policy (Installations and Logistics), subject: Fact Sheet for DCA IWCS Briefing, 8 May 1968, dated 7 May 1968.

Defense Communications Agency (DCA-313), Memorandum for General Besson, subject: Communications Problem Areas (U), 11 June 1969 (CONFIDENTIAL).

recommended that the feasibility of a coastal submarine cable be explored. (This had been previously considered with reference to a proposed joint military - civilian system, NORTHERN TOLL.) In November 1965, the Director, Defense Communications Agency (DCA) visited RVN where he found that the long lines systems were still inadequate to handle current message traffic. He concluded that a coastal cable from Vung Tau to Da Nang was necessary.¹⁰ On 3 November 1965, Commander United States Military Assistance COMUSMACV, in a message to CINCPAC, Command, Vietnam recommended that the cable project be considered in conjunction with the actions to expand and upgrade the IWCS. On 24 November 1965, CINCPAC validated the requirement to the Joint Chiefs of Staff as a military project.¹¹ The sequence of actions involved in the 439L project is shown in Table C-2, and the increase in channel capacity is shown in Figure C-6.¹²

The scope of the 439L coastal cable project was as follows.¹³

Geography - 1,600 miles of cable, Da Nang, RVN, to Sattahip, Thailand

Contract Cost - \$28,000,000

Material - \$5,000,000 direct purchase plus \$11,000,000 in subcontract

6. **MAJOR PROBLEM AREAS.** A number of significant problems were faced during the course of the IWCS buildup. These problems are considered particularly important because

¹⁰ CINCPAC, Command History 1965 (Annex A USMACV) (U), 2 May 1966, pp. 385, 387-8 (TOP SECRET).

¹¹ CINCPAC, Command History 1966 (Annex A USMACV) (U), 27 April 1967, with Change 1, 20 July 1967 p. 311 (TOP SECRET); CINCPAC, Command History 1965 (Annex A USMACV) (U), 2 May 1966, p. 520 (TOP SECRET).

¹² Defense Communications Agency, Annual Report of the Director for the Period 1 July 1965-30 June 1966 (U), 15 August 1966, p. 29 (SECRET); Defense Communications Agency, Annual Report of the Director for the Period 1 July 1966 - 30 June 1967, undated, p. 99 (SECRET).

¹³ Page Communications Inc., subject: IWCS, 1 May 1969.

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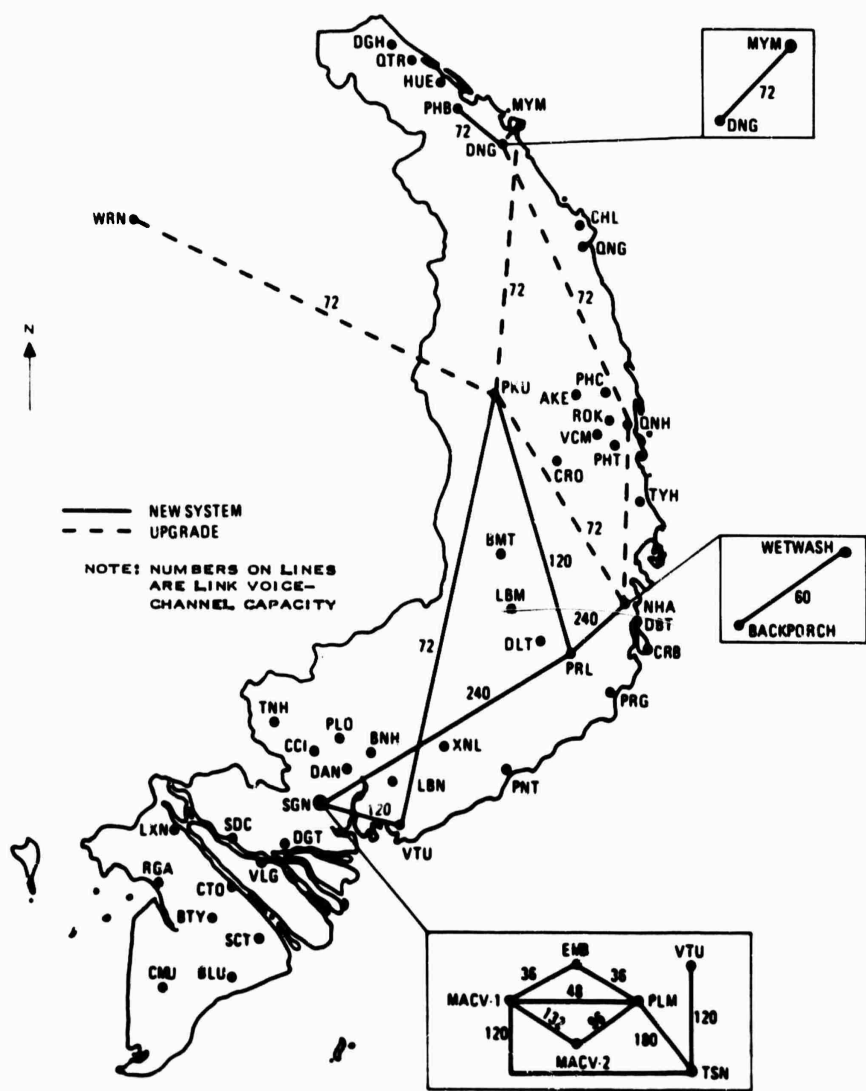


FIGURE C-3. IWCS - PHASE I

Source: USARPAC, Communications Evaluation in Southeast Asia (COMSEA) (U), 17 June 1969, p. C-27 (CONFIDENTIAL).

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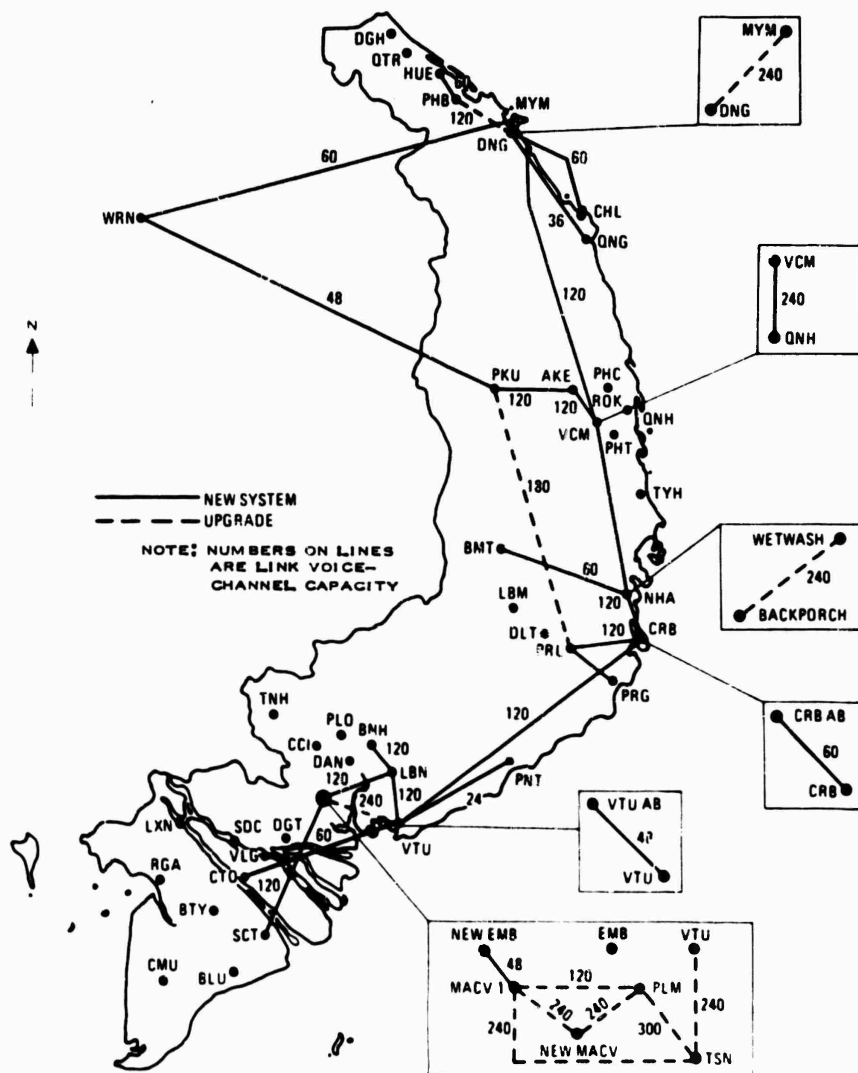


FIGURE C-4. IWCS - PHASE II

Source: USARPAC, Communications Evaluation in Southeast Asia (COMSEA) (U), 17 June 1969, p. C-30 (CONFIDENTIAL).

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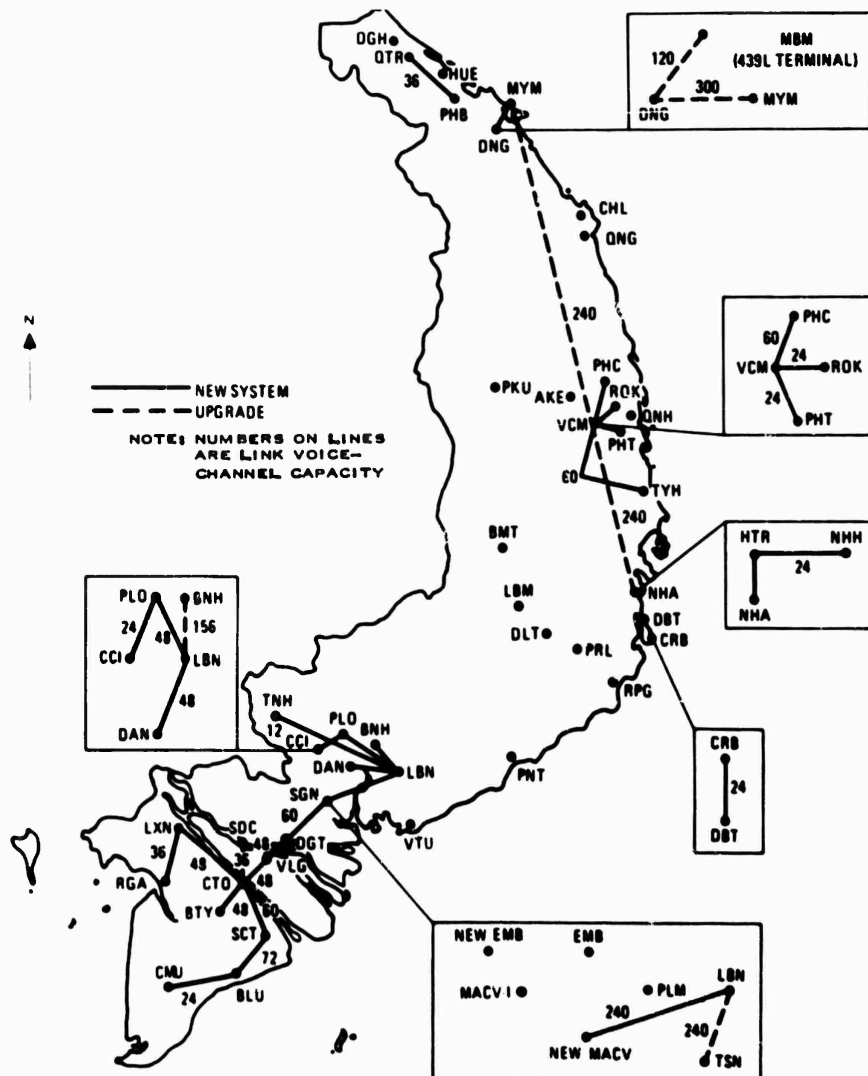


FIGURE C-5. IWCS – PHASE III

Source: USARPAC, Communications Evaluation in Southeast Asia (COMSEA) (U), 17 June 1969, p. C-33 (CONFIDENTIAL).

Source: Figure supplied by AFCS.

TABLE C-2

TIME-PHASED SEQUENCE OF 439L CABLE ACTIONS

<u>Item</u>	<u>Action</u>	<u>Date</u>
1	CINCPAC validated requirement to JCS	Nov. 65
2	DOD approves Air Force TPO for coastal cable	Feb. 66
3	AF awards contract	Mar. 66
4	DOD approves Air Force TPO to add cable from Vietnam to Thailand	May 66
5	First link operational	Feb. 67
6	Last link operational	May 67

Sources: CINCPAC, Command History 1965 (Annex A USMACV) (U), 2 May 1966, pp. 385, 387-8 (TOP SECRET).
 CINCPAC, Command History 1966 (Annex A USMACV) (U), 27 April 1967, with Change 1 dated 20 July 1967, p. 311 (TOP SECRET).
 CINCPAC, Command History 1965 (U), Volume II 13 May 1966, p. 500 (TOP SECRET).
 Defense Communications Agency, Annual Report of the Director for the Period 1 July 1965-30 June 1966 (U), 15 August 1966, 1. 29 (SECRET).
 Defense Communications Agency, Annual Report of the Director for the Period 1 July 1966-30 June 1967 (U), undated, p. 99 (SECRET).

they are the type that can be expected to occur in a similar situation, where logistical and communications systems are being established concurrently. These problems were:^{14, 15}

a. Delay of Phase I Due to Increased Requirements. Requirements were still being engineered on the operational date December 1965, that MACV had requested for Phase I. CINCPAC had, in the meantime, validated and forwarded COMUSMACV's requirements in support of the first large scale troop buildup. Owing to the impact of these additional requirements on Phase I sites and because Phase I was still being engineered, a decision was made to re-engineer those Phase I sites where Phase II increased or provided additional communications. This delayed the construction of some Phase I sites.

b. Lack of Detailed Definition of System Requirements. Because of the graduated nature of the troop buildup, the volume and type of traffic and the disposition of users were not known early enough in sufficient detail to enable proper engineering of the trunking system to support adequately channel density. The logical steps in fixed-plant network engineering could not be followed: traffic engineering, plant engineering, transmission engineering, and equipment engineering.

c. Overall Shortage of Heavy Construction Equipment In-Country. Several construction problems were encountered at the Vietnam sites due to the inability of Page Communications Inc.

¹⁴Defense Communications Agency, Memorandum for the Director, Telecommunications Policy (Installations and Logistics), subject: Fact Sheet for DCA IWCS Briefing, 8 May 1968, dated 7 May 1968; Defense Communications Agency (DCA-313), Memorandum for General Besson, subject: Communications Problem Areas (U), (CONFIDENTIAL).

¹⁵Except where specifically indicated, these problems are extracted from the above listed DCA papers.

engineers (the prime contractor) to obtain qualified subcontractors for site construction. Late in 1965 by direct contact between Army, Navy Officer in Charge, Construction Vietnam, and MACV (MACV established construction priorities in Vietnam), it was agreed that the Army would provide funds to the OICC who would task RMK/BRJ, providing the work was in an area in which this contractor was already mobilized. Page Communications Inc. was permitted to procure small cement mixing equipment and other minor construction equipment. The Army furnished cranes from CONUS and bulldozers from Japan.

d. Shortage of Materials. Page Communications Inc. subcontractors competed for components such as relays, capacitors, terminal blocks, copper, rubber, and other government-controlled items with second, third, and fourth tier vendors who were also supplying subcontractors on other contracts. Additionally, there were other Government and defense procurement that had priorities equal to or higher than the ICWS programs. Buying had saturated industry to the point that delivery dates could not be accelerated by offering premium prices; business was so good that many firms refused to accept a contract or subcontract with a penalty clause. In many cases, subcontracts were awarded to firms that offered the best delivery dates and not necessarily to the firm with the lowest price; however, the majority of suppliers failed to meet promised delivery dates. The basic causes of their delinquency were the delayed delivery of components or raw material and the shortage of skilled labor.

7. IMPACT. The overall impact of the preceding facts was that, although the initial requirements were projected in August 1964, the first circuits provided by the programming-budgeting-contracting cycle were placed in service in December 1966, by which time U.S. strength exceeded 350,000 personnel. The immediate systems placed in service were those provided by deployment of heavy tropo and other tactical mobile/transportable communications equipment. In October 1967, approximately 70 percent of the DCS circuits in Vietnam were provided by tactical equipment.¹⁶

¹⁶Defense Communications Agency (DCA-313), Memorandum for General Besson, subject: Communications Problem Areas (U), 13 June 1969, p. 1 (CONFIDENTIAL).

APPENDIX D

BUILDUP OF VOICE SWITCHING NETWORKS IN RVN

1. **PURPOSE.** The purpose of this appendix is to provide the background of the buildup of the voice-switching networks in Vietnam (RVN).

2. **PREVIOUS PLANNING ACTIONS.** As noted in Appendix A, although the basic telephone networks in Vietnam were not satisfactory prior to June 1964, plans had not been initiated to correct the situation because the major effort had been devoted to decreasing the U. S. military commitment in Vietnam. In June 1964, MACV proposed to the Commander in Chief, Pacific (CINCPAC), that an overall traffic study be made to provide the basis for definitive planning of an integrated telephone network in RVN. This included consideration of four-wire long distance switches at Da Nang, Pleiku, Nha Trang, and Tan Son Nhut. A revised plan of study providing additional data was submitted to Commander in Chief, Pacific, in October 1964.¹

3. **EFFECT OF FORCE BUILDUP.** As the number of U. S. forces in RVN increased rapidly in 1965, the telephone systems further deteriorated.² This deterioration directly affected the logistics users because these common-user systems were the major means used for passing logistical voice traffic. Thus, the logistical users, due to their normally low priority, suffered disproportionately. Several factors affected the capability of these systems to perform their tasks:

a. **Uncontrolled Growth.** The telephone system had grown from the basic tactical method of communication within command channels. There was no overall management of the voice-switching network. As a result, trunks often paralleled each other from Army base to Army base, and Air Force base to Air Force base.³

b. **Overloaded Manual Switchboards.** Operators were too busy to monitor effectively their circuits. Pick-up times of 3 to 5 minutes were common on the busy boards during peak traffic hours. Thus, not only were subscribers forced to route their own calls, but after completion of the call through the first operator, if the distant operator failed to answer, the calling party could not flash the operator back but was disconnected to join the queue again.⁴ This was not satisfactory to a generation used to the reliable dial phones of the Bell System, who now demanded equivalent service. This led to the situation where, while one staff officer was tying up the operator by demanding an explanation of slow service, several other staff officers were cranking their generator handles furiously trying to get the attention of the same operator so that they, too, could discuss his reasons for being asleep at his job.⁵

c. **Two-Wire Long-Distance Switchboards.** Long-distance telephone service was not satisfactory as path losses were often too great for either conversation or signaling. The drop

¹United States Army, Pacific, History of US Army Operations in Southeast Asia, 1 January 1964 to 31 December 1964 (U), 30 April 1965, pp. 164-165 (TOP SECRET).

²United States Army, History of the US Army Operations in Southeast Asia, 1 January 1965 to 31 December 1965 (U), 13 September 1966, p. 181 (TOP SECRET).

³Defense Communications Agency-Southeast Asia Mainland Region, Commanders' Report, 1 July 1966 - 1 July 1967 (U), undated, Sec. II, Tab H (CONFIDENTIAL).

⁴Ibid.; Joint Chiefs of Staff (JGM 585-69), Memorandum for the Chairman, Joint Logistics Review Board, subject: Communications Problem Areas (U), 11 June 1968 (CONFIDENTIAL).

⁵Department of the Navy, HQS Marine Corps JLRB-FMF-bdd, Memorandum for the Coordinator Task Force D, JLRB, subject: Communications-Electronics Information, 3 July 1969, p. 5.

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losses in the local telephone distribution system, which were unavoidable with the equipment used, allowed satisfactory local telephone conversations; however, when combined with the use of two-wire switching on long-distance trunks, these losses made calls routed through more than three switchboards virtually impossible.⁶

d. Low Restoration Priorities on Common-User Trunks. The majority of common-user trunks in RVN were assigned low circuit restoration priorities (3 & 4). Because of this low restoration priority, these circuits were either preempted when a higher priority circuit required restoration, or the technical controllers became so involved in the maintenance of high-priority circuits that the common-user trunks were not maintained.⁷

e. Effects of Dedicated Circuits. Further deterioration of the common-user network was caused by user requirements for dedicated circuits to ensure mission accomplishment. These requirements deleted trunks from the common-user pool. As of April 1968, approximately 85 percent of the total communication channels in RVN were sole-user.⁸

4. LOCAL SERVICE ACTIONS. The local telephone service problems, including provision of dial central offices (DCOs), were handled by the component commander predominant in each area.

a. Planning. Various separate programming actions were initiated for DCOs in 1964 and 1965. To ensure proper action at all locations where DCOs were required, a conference was held in September 1965 by CINCPAC, during which all locations in SE Asia where DCOs were to be provided were identified, and the agency responsible for installing and operating each of these facilities was designated.⁹

b. Implementation. There was a series of actions that provided relief at the local level.

(1) Immediate efforts were made to replace the tactical switchboards, SB-86 and SB-22s, with larger capacity manual boards.

(2) The Army had six transportable 600-line DCOs, AN/TTC-28s, installed in vans and shipped to SE Asia. These were used to provide immediate temporary relief in various locations by replacing manual switchboards, AN/MTC-1s, which in turn were used to replace smaller manual switchboards, SB-86s and SB-22s, at other locations. The sequence of events in obtaining this capability is shown in Table D-1.¹⁰ This table shows that it was 17 months from the time USARPAC initially requested these transportable DCOs to the time when these DCOs were operational in RVN.

⁶Joint Chiefs of Staff (JGM 585-69), Memorandum for the Chairman, Joint Logistics Review Board, subject: Communications Problem Areas (U), 11 June 1969 (CONFIDENTIAL). The effect of two-wire switches is documented in detail in the TM 11-486-1, -11 series.

⁷1st Signal Brigade, Letter, subject: Operational Report of Headquarters 1st Signal Brigade (USASTRATCOM) for Period Ending 30 April 1968 (U), 14 May 1968, p. 24 (CONFIDENTIAL).

⁸Ibid.: Joint Chiefs of Staff (JGM 585-69), Memorandum for the Chairman, Joint Logistics Review Board, subject: Communications Problem Areas (U), 11 June 1969, p. 6 (CONFIDENTIAL).

⁹USARPAC, History of the U. S. Army Operations in Southeast Asia 1 January 1965 to 31 December 1965 (U), 13 September 1966, pp. 181-186 (TOP SECRET).

¹⁰USARPAC, Annual Historical Summary Part II Southeast Asia 1 January to 31 December 1966 (U), 15 February 1968 pp. 502, 505 (TOP SECRET); USARPAC, History of the U. S. Army Operations in Southeast Asia 1 January 1965 to 31 December 1965 (U), 13 September 1966, pp. 181-186 (TOP SECRET). Defense Communications Agency-Southeast Asia Mainland Region Commanders' Report, 1 July 1966 - 1 July 1967 (U), undated Highlights (CONFIDENTIAL).

TABLE D-1
TIME-PHASED SEQUENCE OF VOICE-SWITCHING ACTIONS

Item	Transportable Local DCOs	Fixed Plant Local DCOs	Long-Distance Service	Date
1			Initial study requirement projected by MACV	June 64
2			MACV submits revised plan for study to CINCPAC	Oct. 64
3			CINCPAC requests additional information be provided by MACV	Dec. 64
4	USARPAC request DA provide 15 400-line transportable DCOs for RVN			15 May 65
5	DA requests justification of DCOs and additional information			7 Jul. 65
6	USARPAC requests DA procure 6 transportable DCOs	USARPAC requests DA procure 15 fixed-plant DCOs		Aug. 65
7		DA requests STRATCOM to begin engineering, procurement and contractual action for 15 fixed-plant DCOs for RVN		Aug. 65
8		MACV recommends development of a common-user Automatic Telephone System for RVN consisting in part of Army and Air Force DCO facilities	MACV recommends development of a common-user Automatic Telephone System for RVN consisting in part of Army and Air Force DCO facilities	Sep. 65
9		CINCPAC holds conference, identifies all RVN DCO locations and responsible service, and requests DCA-PAC to develop automatic telephone system plan for RVN	CINCPAC holds conference, identifies all RVN DCO locations and responsible service, and requests DCA-PAC to develop automatic telephone system plan for RVN	Sep. 65

TABLE D-1

TIME-PHASED SEQUENCE OF VOICE-SWITCHING ACTIONS (Continued)

Item	Transportable Local DCOs	Fixed Plant Local DCOs	Long-Distance Service	Date
10		Contract awarded for DCOs to Stromberg-Carlson Corp. by STRATCOM	Program to provide Tandem Switches approved by the Deputy Secretary of Defense	Apr. 66
11			CINCPAC requests DCA-PAC hold conference to develop an interim long distance plan for RVN	Jul. 66
12			DCA-PAC holds conference on interim LD plan for RVN	Sep. 66
13	First transportable DCO operational			Nov. 66
14		First fixed-plant Army DCO cutover to operation (MACV I)		Jan. 67
15			Interim LD network operational	Apr. 67
16			Contract awarded for Tandem Switches	Jun. 67
17		29 fixed-plant DCOs with over 34,000 lines are in operation in RVN		Dec. 67
18			First Tandem Switch cutover in RVN	Feb. 69

Sources:

CINCPAC, Command History 1965 (U) Volume II, 13 May 1966, p. 525 (TOP SECRET). USMACV, 1967 Command History Volume II (U), 16 September 1968, p. 787 (TOP SECRET). USAF-PAC, History of U.S. Army Operations in Southeast Asia, 1 January 1964 to 31 December 1964 (U), 30 April 1965, p. 164-5 (TOP SECRET). USARPAC History of the U.S. Army Operations in Southeast Asia 1 January 1965 to 31 December 1965 (U), 13 September 1966, pp. 181-186 (TOP SECRET). USARPAC Annual Historical Summary Part I, General Summary 1 July 1965 - 31 December 1966 (U), 15 February 1966, pp. 502-505, 508-509 (TOP SECRET). Interview by Major Binder, CO 23d Military History Detachment with Maj. Aaron E. Wilkins, CEEIA Inside Plant, 1st Signal Brigade, subject: Dial Central Office Program for Southeast Asia; 11 August 1967. Defense Communications Agency (DCA-313), Memorandum for General Besson, subject: Communications Problem Areas (U), 13 June 1969 (CONFIDENTIAL); Defense Communications Agency, Annual Report of the Director for the Period 1 July 1966 - 30 June 1967 (U), undated p. 99 (SECRET). Defense Communications Agency - Southeast Asia Mainland Region, Commanders' Report, 1 July 1966 - 1 July 1967 (U), undated (CONFIDENTIAL); Section II, TAB H: Highlights 1st Signal Brigade, Command Progress Report 4th Qtr FY 68 (U), 6 August 1968 p. IV-3 (CONFIDENTIAL).

(3) Fixed-plant dial central offices were programmed and placed in service. The majority of these were contract actions involving both the Army and the Air Force. The time-phased sequence of events used to provide the local dial central offices in RVN by the Army by contract is shown in Table D-1.¹¹ This table shows that:

(a) It took 8 months from the time USARPAC requested that Department of the Army procure 15 fixed-plant DCOs until a contract was let.

(b) From the time the contract was let until the first fixed-plant DCO from that contract was in operation, 9 months had elapsed. (In two cases, materials previously scheduled to be installed elsewhere were diverted to Vietnam. These were a 1,200-line office to be installed in Qui Nhon and a 2,400-line office to be installed at Cam Ranh Bay. The Cam Ranh Bay installation was cut over to service on 15 April 1967. Significant delays were experienced at this site because of a shortage of materials, severe transportation problems and a lack of engineering support. The Qui Nhon installation was cut over to service during the 2nd Quarter, FY 1968 and was also subject to the problems detailed above.)¹²

(4) Ten Air Force DCOs were installed using the organic capability of the Air Force Ground Electronics Engineering Installation Agency. Material was procured from commercial sources.

(5) By the end of 1967, 29 fixed-plant dial central offices with over 34,000 local lines were in operation in RVN.¹³ These, in turn, released other assets, both transportable DCOs and manual switchboards, which were used to upgrade service at other points in RVN.

c. Example. An example of the continuous upgrading that occurred is as follows:¹⁴

(1) Within a short time of their deployment Marine units found that the 30-line manual switchboard SB-86 (expandable to 60 lines), which was the largest switchboard in their tactical inventory, was completely inadequate in terms of capacity and speed, and was incapable of providing sustained service without excessive maintenance. As a result the Commanding General (CG), III Marine Amphibious Force (MAF), initiated a requirement for multi-position switchboards for use of major Marine Commands in November 1965.

(2) As a result of this initial request and further actions to upgrade the voice switching system in III MAF, the Marine Corps tactical switching system underwent the following improvements:

(a) January 1966. III MAF (Da Nang) activates its first AN/MTC-1, 200-line, manual switchboard. At the same time the Air Force allocates 40 local lines off its dial central office in Da Nang for Marine use.

¹¹USARPAC, Annual Historical Summary Part II Southeast Asia 1 January to 31 December 1966 (U), 15 February 1968, pp. 502, 504 (TOP SECRET). Interview by Major Binder, CO 23rd Military History Detachment with Major Aaron E. Wilkins, CEEIA Inside Plant, 1st Signal Brigade, subject: Dial Central Office Program for Southeast Asia 11 August 1967, Chart 2.

¹²USARPAC, History of the U. S. Army Operations in Southeast Asia 1 January 1965 to 31 December 1965 (U), 13 September 1966, pp. 183-187 (TOP SECRET). Interview by Major Binder, CO 23rd Military History Detachment with Major Aaron E. Wilkins, CEEIA Inside Plant, 1st Signal Brigade, subject: Dial Central Office Program for Southeast Asia, 11 August 1967. 1st Signal Brigade, Command Progress Report 4th Qtr FY 68 (U), 6 August 1968, p. IV-3 (CONFIDENTIAL).

¹³CINCPAC, Command History Volume II 1967 (U), 18 September 1968, p. 787, (TOP SECRET). The following material was abstracted from Dep Mar Cor Rep, JLRB Memos of 17 June 69, 20 June 69, 30 June 69, and 8 Jul 1969, subject: Historical Review of the Communications As It Supported the Vietnam Buildup; and FMFPAC ltr 10B/bkh, 4000 of 21 Jun 69. subject: Joint Logistics Review Board Requirement except where specifically noted.

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(b) June 1966. The 3d Marine Division (Da Nang) activates an AN/MTC-1. The Force Logistic Command (FLC) remains on SB-86s.

(c) August 1966. The 1st Marine Division (Chu Lai) and the 1st Marine Air Wing (Da Nang) activate AN/MTC-1s.

(d) October 1966. The 1st Marine Division displaces to Da Nang and takes over 3d Marine Division facilities including its switchboard. At the same time the 3d Marine Division displaces to Phu Bai where it reverts to SB-86 employment.

(e) June 1967. The Army assumes responsibility for communications in the Chu Lai Tactical Area of Responsibility (TAOR), and installs an AN/MTC-9, 600-line manual switchboard. Marine units are served by this system. At the same time construction is started by the Army on a dial central office to service this area.

(f) December 1967. The 1st Marine Aircraft Wing installs an AN/TTC-7, 200-line, manual central office switchboard.

(g) January 1968. A 2,400-line fixed-plant dial central office at Phu Bai has been cut over to service by the Army. The construction of the 2,400-line fixed-plant dial central office at Chu Lai is completed by the Army and is turned over to the Navy for activation and operation.¹⁵

(h) March 1968. Force Logistic Command (FLC) activates the Marine Corps first transportable dial central office, AN/TTC-28.

(i) July 1968. The 3d Marine Division (Dong Ha) activates a transportable dial central office set, AN/TTC-28.

(j) October 1968. Headquarters, III MAF, activates a transportable dial central office set, AN/TTC-28.

(k) December 1968. The 1st Marine Division activates a transportable dial central office set, AN/TTC-28.

(l) February 1969. The 1st Marine Aircraft Wing becomes a subscriber on the Air Force dial system in Da Nang.

5. LONG-DISTANCE SERVICE ACTIONS. A series of actions, both short- and long-range, were taken to provide better long-distance service.

a. Initial Planning Actions. At the September 1965 conference, which also dealt with local DCO actions, CINCPAC tasked DCA-PAC, in coordination with other agencies to develop a system Plan for Automatic Telephone Service in SE Asia.¹⁶ This plan provided design criteria to ensure compatibility of equipment, and also identified the requirement for 9 four-wire long-distance automatic switchboards, the Tandem Switching Centers.¹⁷

b. Long-Term Action. The time-phased sequence of actions to provide these is shown in Table D-1.¹⁸ This table shows that:

¹⁵1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 31 January 1968 (U), 14 February 1968, p. 7 (CONFIDENTIAL).

¹⁶USARPAC, History of the U. S. Army Operations in Southeast Asia 1 January 1965 to 31 December 1965 (U), 13 September 1966, p. 183 (TOP SECRET).

¹⁷Ibid., p. 186.

¹⁸USARPAC, History of U. S. Army Operations in Southeast Asia, 1 January 1964 to 31 December 1964 (U), 30 April 1965, p. 164-165 (TOP SECRET). USARPAC, History of the U. S. Army Operations in Southeast Asia 1 January 1965 to 31 December 1965 (U), 13 September 1966, pp. 181-186 (TOP SECRET). Defense Communications Agency, Annual Report of the Director for the Period 1 July 1966 - 30 June 1967 (U), undated, p. 99 (SECRET).

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(1) From the time that MACV recognized the problem until DCA-PAC was requested to develop an Automatic Telephone System Plan, 15 months had elapsed.

(2) From the time that DOD approved the Tandem Switch Program until a contract was let to provide the equipment, 14 months had elapsed.

(3) From the time that the contract was awarded until the first Tandem Switch was cut over in RVN, 20 months had elapsed.

c. Further Planning Actions. As the force deployments increased in RVN, the long-distance switching networks further deteriorated. In view of the urgent need for improved long distance telephone service, DCA-PAC, at the request of CINCPAC, held a further conference with the Services in September 1966. The outcome of this conference was the Time-Phased Implementation Plan for Telephone Service in SE Asia. The objective of this interim plan was to implement a common-user long distance telephone system in SE Asia, leading to the automatic telephone service described above. Specific actions to be accomplished by this plan were to relocate existing assets to long distance use and to implement more efficient operation (i. e., plug supervision and operator direct dial circuits.)¹⁹ This interim common-user long-distance telephone system was operational by July 1967 and provided manual long-distance switchboards at Da Nang, Qui Nhon, Pleiku, Nha Trang, Tan Son Nhut, and Can Tho.²⁰

d. Additional Implementing Actions. To overcome the difficulties of long distance calling, a number of additional methods were tried. These included:²¹

- (1) Dedicated circuits.
- (2) Special switchboards netted together.
- (3) A special "Blue Arrow" telephone procedure to give general officers special service.
- (4) A class "A" - class "C" system to restrict access to the long distance system.

6. MAJOR PROBLEM AREAS. A number of major problems were met during the course of the DCO and Tandem Switch Programs. These were basically the same type of problems previously identified as affecting the long lines buildup and included:

a. Lack of Required Construction Priority. To house the dial telephone equipment, buildings were required. These were not built by the prime contractor but were furnished as Government Furnished Equipment. Substantial priority conflicts were encountered in building construction which delayed emplacement of the dial equipment.²²

b. Shortage of Qualified Personnel. This problem included both enlisted men and officers. For example, Army personnel with MOS 36E, cable splicer, required for cable

¹⁹USARPAC, Annual Historical Summary Part II Southeast Asia 1 January to 31 December 1966 (U), 15 February 1967, p. 508 (TOP SECRET). Defense Communications Agency-Southeast Asia Mainland Region Commanders' Report, 1 July 1966 - 1 July 1967 (U), undated, Section II-8 (CONFIDENTIAL).

²⁰USARPAC, Communications Evaluation in Southeast Asia (COMSEA) (U), 17 June 1969 (CONFIDENTIAL).

²¹Van Harlingen, W. M. BG, Debriefing Report (U), 18 January 1969 pp. 15-17 (CONFIDENTIAL).

²²1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 31 October 1966 (U), undated, pp. 13-14 (CONFIDENTIAL). 1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 31 January 1967 (U), 14 February 1967, p. 13 (CONFIDENTIAL); 1st Signal Brigade, Fourth Quarterly FY 67 Command Progress Report (U) 28 July 1967, pp. 3-25 (CONFIDENTIAL). 1st Signal Brigade, Command Progress Report 4th Qtr FY 68 (U) 6 August 1968, p. IV-35 (CONFIDENTIAL).

construction, were in continuous critical short supply through July 1968.²³ The lack of sufficient government personnel to engineer outside plant support was also a delaying factor.²⁴

c. Inability of the Army Depot System in Vietnam to Identify and Issue Required Material. The depots were unable to identify, locate, or relate the item to its intended usage in many cases.²⁵ In January 1967 major efforts were still being made to locate and identify, by visual inspection, material in the Army depots.²⁶ (This problem has been recognized, and a concept has been developed to overcome these difficulties.)²⁷

d. Lack of Heavy Construction Equipment. This included bulldozers, trench diggers, and other equipment for outside plant construction.²⁸

7. IMPACT. The overall impact of the above was that although the problem areas had been identified as early as June 1964, the first significant major improvement in local telephone service was provided in January 1967. By December 1967 the majority of the local dial central offices had been placed in operation. However, as of January 1969, the long-distance service was still unsatisfactory.²⁹

²³Ibid., pp. III-1, 8; 1st Signal Brigade, Company A, 40th Signal Battalion, A Signal Construction Company in Support of Operations in Vietnam, June 1967, pp. 39-41.

²⁴Interview by Major Binder, CO 23rd Military History Detachment with Major Aaron E. Wilkins, CEEIA Inside Plant, 1st Signal Brigade, subject: Dial Central Office Program for Southeast Asia, 11 August 1967, pp. 8, 10, 11.

²⁵1st Signal Brigade, Company A, 40th Signal Battalion, A Signal Construction Company in Support of Operations in Vietnam, subject: June 1967, pp. 16-17.

²⁶1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 31 January 1967 (U), 14 February 1967 p. 14 (CONFIDENTIAL).

²⁷This concept includes:

- a. Intensive management for key C-E items.
- b. "Stove Pipes" for repair of C-E items to key CONUS depots or direct to manufacturer.
- c. Courier of containers of repair parts direct to specific addresses.
- d. Critical assemblages to be sent to the theater in one supply package. (Briefing to the JLRB by BG Rienzi, ACS C-E, USARV, Long Binh, Vietnam).

²⁸1st Signal Brigade, Company A, 40th Signal Battalion, A Signal Construction Company in Support of Operations in Vietnam, June 1967, p. 35-37.

²⁹Van Harlingen, W. M., BG, Debriefing Report (U), 18 January 1969, p. 15 (CONFIDENTIAL).

APPENDIX E

BUILDUP OF MESSAGE SWITCHING NETWORKS IN RVN

1. **PURPOSE.** The purpose of this appendix is to provide the background of the buildup of the message-switching networks in RVN.
2. **GENERAL.** The AUTODIN Project had been previously established to fully automate the electrical transfer of information contained on 80-column Electric Accounting Machine (EAM) cards as well as teletype messages.¹ Pending acquisition of this fully automated capability, in addition to the standard teletype torn-tape relay, a manual relay network for EAM cards, called interim AUTODIN, had been established throughout the Pacific. Both of these were eventually merged in Vietnam into one network, which handled both cards and paper tape.
3. **TELETYPE.** Major expansion in the teletype message-switching network was immediately required owing to the troop buildup.

- a. **Major Relay Expansions.** The major relays in RVN increased from one to three. Each of these three, in turn, expanded in capacity.

- (1) Initially, the only major relay in Vietnam was located at the Phu Lam facility. Under the pressures of increased traffic, this relay grew from 30 to 52 lines before the end of 1965 and to 72 lines before the end of 1966.²

- (2) On 2 September 1965, Department of the Army (DA) directed the Strategic Communications Command (STRATCOM) to establish an interim-tape relay facility at Nha Trang. Transportable equipment (AN/TSC-48 and AN/TSC-50 vans) arrived at Nha Trang on 25 October 1965. On 3 November the facility was in operation using personnel on TDY from STRATCOM-CONUS for the initial activation. These vans were replaced on 30 April 1966 by fixed-plant equipment with a capacity of 22 lines, which was further expanded in December 1966 to 44 lines. The AN/TSC-48/50, were then exchanged by STRATCOM, the old units being returned to the United States to be rehabilitated.³

¹AUTODIN evolved from the requirements of the Air Force logisticians for data transmission. The initial step by the Air Force was the development of the formatted teletype (FORTEL) system to expedite high priority requisitions to the Air Force Logistics Command (AFLC) item managers or weapon system managers. This system reduced transmission time from 3-4 days to 3-4 hours; however, because the AFLC Supply Systems were automated, the teletype messages received at the depot had to be converted to punch cards for entry into the AFLC computer. It soon became apparent that the time gained in the transmission cycle was being lost in the creation of punch cards. This situation indicated that some method be developed to transmit punched cards. This was achieved by establishing the AFLC LOGistic COMMunication (LOGCOM) network and the LOGistic BAListic (LOGBAL) network. Those networks provided the capability for major U.S. Air Force bases and missile squadrons to transmit consumption and requisition data via punch cards to various AFLC inventory managers, using data transceivers. Again, this system could not support the continuing demand for logistic support; therefore, the data transceivers networks were replaced by AUTODIN. This development was assumed by DCA acting for DOD, and made available to all DOD components for all types of traffic. (Air Force Manual 106-16, Automated Communications, 1 June 1967, p. 23.)

²G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), draft, 22 May 1969, pp. 50-58 (CONFIDENTIAL).

³Ibid.; USA STRATCOM, History of the U. S. Army Strategic Communications Command FY 1966 (U), undated, p. 18 (CONFIDENTIAL).

(3) Formal planning started on 8 June 1966 for the engineering, installation, and operation of a 48-line major relay at Da Nang with a target date of 1 October 1966 for an operational 24-line capability.⁴ When the operational date for this new relay was delayed and the increased traffic load in the Da Nang area indicated the immediate upgrading of communications facilities there, the AN/TSC-48/50 vans were deployed to Da Nang to serve as an interim major relay. This was activated on 18 December 1966 reaching a traffic load of 5000 messages per day within 3 days.⁵ On 26 February 1967, the Da Nang interim tape relay, AN/TSC-48/50, was destroyed by fire as a result of an enemy rocket attack of the Da Nang Air Base. Identical AN/TSC-48/50 vans located at Fort Huachuca were flown to Da Nang, and the tape relay was restored on 8 March 1967.⁶ On 30 April 1967, the Da Nang fixed-plant tape relay became operational, releasing the AN/TSC-48/50. This relay was subsequently expanded from its initial 24-line capacity to 35 lines by 31 July 1967.⁷

(4) The time-phased sequence of actions of the expansion of the teletype major relays is shown in Table E-1. This shows for the teletype relays:

(a) Use of on-hand contingency equipment (AN/TSC-48/50) permitted rapid establishment of an initial limited (18-line) capability.

(b) The limited capability of the contingency equipment was replaced by larger-capacity fixed-plant stations within 6 months of deployment.

(c) The initial fixed-plant capability was then further expanded.

b. Tributaries. The tributaries expanded in a similar fashion. A typical example of the experiences of the users is as follows:⁸

(1) In keeping with past policy of equipping Marine combat forces with highly mobile equipment, and team or man-packed equipment, the communications units of ground and air organizations were deployed in RVN with tactical teletypewriters, teletype reperforators, and ancillary items that were considered adequate for a landing force whose mission ashore was expected to be of limited duration. However, this equipment had never been tested in sustained operations at near maximum capacity for days, weeks, and months. This equipment, for the most part, was designed to operate at speeds of either 60 or 100 words per minute (WPM). However, after a short period of trial and error, most units found that the 60 WPM rate was more than the equipment could stand for continued operation of even a few days, and 100 WPM was impractical for even a few hours.

(2) As a result of the above inadequacies and as increasingly heavy traffic loads created message backlogs for force, division, and wing levels, the following actions were initiated to upgrade the teletype system.

(a) June 1965. Air Transportable Communication Unit (ATCU) 100 A from Commander In Chief, Pacific Fleet, with teletype, cryptographic, and control facilities was deployed to Da Nang to support the combined III Marine Amphibious Force (MAF) and 3d Marine

⁴USA Regional Communications Group, Letter, subject: Operational Report for Quarterly Period Ending 31 July 1966 (U), 16 August 1966, p. 3 (CONFIDENTIAL).

⁵1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 31 January 1967 (U), 14 February 1967, p. 7 (CONFIDENTIAL).

⁶1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 30 April 1967 (U), 14 May 1967, p. 12 (CONFIDENTIAL).

⁷1st Signal BRIGADE, Letter, subject: Operational Report for Quarterly Period Ending 31 July 1967 (U), 14 August 1967, p. 10 (CONFIDENTIAL).

⁸Except where specifically noted the following material was abstracted from Dep Mar Cor Rep, JLRB memos of 17 June 60, 20 June 69, 30 June 69, and 8 July 69, subject: Historical Review of the Communications As it Support the Vietnam Buildup, and FMFPAC Letter 10B/bkh, 4000 of 21 June 69, subject: Joint Logistics Review Board Requirement.

TABLE E-1

TIME-PHASED SEQUENCE OF MAJOR MESSAGE-SWITCHING NETWORK ACTIONS

<u>Item No.</u>	<u>Phu Lam</u>	<u>Nha Trang</u>	<u>Da Nang</u>	<u>Date</u>
1	Existing capability of major tape relay is 30 lines			1 Jan. 1965
2	DCA completes plan for expansion of digital data services in RVN	DCA completes plan for expansion of digital data services in RVN		11 Aug. 1965
3		DA directs STRAT - COM to set up an interim major tape relay at Nha Trang		2 Sep. 1965
4		Interim facility in operation using AN/TSC-48/50		3 Nov. 1965
5	Secretary of Defense approves plan for expanding digital data service in RVN	Secretary of Defense approves plan for expanding digital data service in RVN		Dec. 1965
6	Capability expanded to 52 lines			1 Jan. 1966
7		Interim major tape relay replaced by fixed-plant with 22-line capacity		30 Apr. 1966
8			Planning initiated for 48 line fixed-plant relay with a 24-line capability to be operational by 1 Oct. 1966	8 Jun. 1966
9			Interim facility operational using AN/TSC-48/50	18 Dec. 1966
10	Capability expanded to 72 lines	Capability expanded to 44 lines		1 Jan. 1967
11			AN/TSC-48/50 destroyed by enemy	26 Feb. 1967
12			Interim capability re-established using AN/TSC-48/50	8 Mar. 1967

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TABLE E-1

TIME-PHASED SEQUENCE OF MAJOR MESSAGE-SWITCHING NETWORK ACTIONS (Continued)

Item No.	Phu Lam	Nha Trang	Da Nang	Date
13			Fixed-plant relay becomes operational	30 Apr. 1967
14		Manual Data Relay Center becomes operational		25 Jul. 1967
15			Capacity expanded to 35 lines	31 Jul. 1967
16			Capacity expanded to 48 lines	1 Jan. 1968
17	AUTODIN Automatic Switching Center Operational			25 Mar. 1968
18		AUTODIN Automatic Switching Center Operational		3 Jun. 1968
19	Manual Data Relay Center deactivated			9 Jul. 1968
20		Teletype changed to a minor relay		9 Dec. 1968

Sources: G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), draft, 22 May 1969, pp. 36, 50-58 (CONFIDENTIAL).
 USASTRATCOM, History of the U. S. Army Strategic Communications Command FY 1966 (U), Undated p. 18 (CONFIDENTIAL).
 1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 31 January 1967 (U), 14 February 1967, p. 7 (CONFIDENTIAL).
 1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 30 April 1967 (U), 14 May 1967, p. 12 (CONFIDENTIAL).
 1st Signal Brigade, Letter, subject: Operational Report for Quarterly Period Ending 31 July 1967 (U), 14 August 1967, p. 10 (CONFIDENTIAL).
 USA Regional Communications Group, Letter, subject: Operational Report for Quarterly Period Ending 31 July 1966 (U), 16 August 1966, p. 3 (CONFIDENTIAL).
 Defense Communications Agency, 1966 Commanders' Conference Report (U), September 1966, pp. 180-190 (CONFIDENTIAL).
 Phu Lam Signal Battalion, Communications Operation Performance Summary (U), March 1968 (CONFIDENTIAL).
 Phu Lam Signal Battalion, Communications Operation Performance Summary (U), July 1968 (CONFIDENTIAL).
 Nha Trang Signal Battalion, Communications Operating Performance Summary (U), June 1968 (CONFIDENTIAL).
 Nha Trang Signal Battalion, Communications Operating Performance Summary (U), December 1968 (CONFIDENTIAL).
 Air Force Communications Service, Communications in Southeast Asia (U), 31 July 1969, pp. 11-3, -7 (SECRET).

Division Communications Center. All incoming and outgoing traffic, including supply and other logistic matters, was relayed through this center.

(b) December 1965. The Commanding General, Fleet Marine Force, Pacific, requested a communications engineering survey team from the Naval Communication System Headquarters to assist in planning communication center facilities for Marine commands in Vietnam. This request was approved by the Commandant of the Marine Corps and Chief of Naval Operations, and the survey team, with one Marine member, arrived in Da Nang on 29 January 1966 to develop plans for the construction and equipping of the required facilities. The plans that were developed called for the installation of high-capacity fixed-plant teletype equipment in a controlled environment as an interim solution to the immediate problem. The recommended long-term solution was the development of transportable equivalents to the fixed-plant equipment to apply to all Fleet Marine Forces.⁹

(c) April 1966. As a result of the lessons learned by its predecessors and the recommendations of the Communications Engineering Survey Team, when the 1st Marine Division deployed in the Chu Lai Tactical Area of Responsibility (TAOR), its communications center was nearly complete and was being equipped with fixed-plant equipment that had been diverted from other projects by Naval Shore Electronic Engineering Activity Pacific which was responsible for the construction and installation.

(d) April and May 1966. To provide for the exchange of information and to coordinate supply action, Force Logistic Command (FLC) activated an internal teletype network employing tactical equipment on channels provided over Marine Amphibious Force (MAF), division, wing, and DCS circuits. Although the terminal and transmitting equipment were as unreliable as ever, they served a useful purpose until replaced.

(e) June 1966. The III MAF, 1st Marine Air Wing (MAW) and 3d Marine Division communications center had fixed-plant equipment installed and operational.

(f) August 1966. FLC was provided with fixed-plant equipment on a temporary basis from local resources pending construction and movement to new facilities at Red Beach. (The move was made in October 1966.) However, III MAF still employed a command communications system with all traffic being relayed through that communications center at a cost of considerable effort and delay.

(g) December 1966. A torn major tape relay station was activated by the Army at Da Nang employing mobile van facilities. This permitted the major Marine commands to become tributary stations in the DCS and somewhat relieved the III MAF communications center.

(3) The improvements outlined above were not accomplished without major problems and growing pains. Much of the equipment was procured on a crash basis from the Navy supply system, and some was diverted from other projects of lower priority. None of the requirements had been planned. As a result the Marine Corps supply system was not geared to meet the unparalleled demands. Field wire and terminal strips nailed to trees are poor substitutes for test stations, frames, and high quality transmission lines, but were used in the early stages because multipair cable and associated hardware were not carried in their supply system. Neither technicians nor operators were familiar with the new equipment. The training of communications personnel to install pole lines, wire main frames, and splice cable had been allowed to lag to the point where, even if the necessary material had been available, only a few officers and staff NCOs were experienced and current in these skills. Marine Corps communications personnel were not familiar with operation of Technical Control facilities, yet efficient operation of high capacity communications systems required this capability.

⁹ Team Leader, Communications Engineering Survey Team, Letter to CGIIIMAF/NCC of 6 February 1966, subject: Report of Communication Engineering Survey Team.

(4) The tactical equipment worked well, as did the personnel, in the role for which it had been designed. However, this role was much too restrictive to meet the demands of Vietnam.

c. Major Problem Area - Communications Discipline. One of the most significant problem areas encountered in message-switching was the abnormal amount of traffic using high precedence indicators. FLASH traffic during this period was extremely high. On 21 August 1966, 606 FLASH messages were processed in the Phu Lam and Nha Trang major teletype relays. On 26 August 1967, 719 were processed.^{10, 11} This overuse of high precedence caused increased handling times at the relay station and led to the situation where a super-precedence (RED ROCKET) was established by the Joint Chiefs of Staff to ensure that the really high precedence actions received expedited handling.¹²

4. DAT

a. Initial Situation. The status of the INTERIM AUTODIN network up to 1 January 1965 has been presented in Appendix A. At that time Phu Lam was acting as a terminal in that network, and not as a relay. On 25 March 1965 a Manual Data Relay Center (MDRC) was activated at Phu Lam.¹³ By August 1965, the existing data capability in RVN consisted of the Manual Data Relay Center at Phu Lam with 10 Card Per Minute (CPM) tributaries at Da Nang, Tan Son Nhut, Saigon, and Bien Hoa and with trunking capabilities of 100 CPM to Manual Data Relay Center (MDRC), Clark, and 3 CPM to MDRC, Fort Buckner, as shown in Figure E-1.¹⁴

b. Limitations. There were certain limitations in the existing network.

(1) The only data relay in RVN was located at Phu Lam. No alternate capability existed to handle tributaries if the relay was disabled. To ensure a continuous flow of data traffic, the establishment of an alternate MDRC in RVN was required.

(2) MDRC, Phu Lam, had been established on an austere basis to provide limited capability for urgently needed common-user digital data traffic and was totally incapable of meeting the growing data requirements. Insufficient trunking and floor space imposed severe restrictions on the number of tributary stations that could be serviced directly from MDRC, Phu Lam. Many validated data users in RVN were thus restricted to nonelectrical and courier services.¹⁵

(3) The limited capabilities of the long-haul trunking network precluded establishment of a high-speed alternate route communications path in the event of disruption of the WET WASH submarine cable extending from the Philippines to RVN. It was clear the three to five cards per minute capability from MDRC, Phu Lam, to MDRC, Buckner, provided by HF, could pass only a very limited amount of high precedence traffic, and was not capable of acting as a high-speed alternate route communications path.¹⁶

¹⁰Defense Communications Agency, 1966 DCA Commanders' Conference Report (U), September 1966, p. 90 (CONFIDENTIAL); Presentation by the Chief, DCA-PAC, to DCA Commanders' Conference, 5 October 1967.

¹¹During this period, April - June 1967, over 31 percent (approximately 2.5 million messages) of the total teletype traffic passing through the major tape relay stations in RVN carried the precedence of "Immediate." (1st Signal Brigade, Fourth Quarter-FY 67 Command Progress Report (U), 28 July 1967, pp. 3-4, 3-6 (CONFIDENTIAL).

¹²W. M. Van Harlingen, Debriefing Report (U), 18 January 1969, p. 14 (CONFIDENTIAL).

¹³G. R. Thompson, U. S. Army Signal Communications Support in Southeast Asia 1950-1967 (U), draft, 22 May 1969, p. 26 (CONFIDENTIAL).

¹⁴Air Force Communications Service, Communications in Southeast Asia (U), 31 July, p. II-6 (SECRET).

¹⁵Ibid.

¹⁶The buildup of the circuit capability is covered in Appendix B to this monograph.

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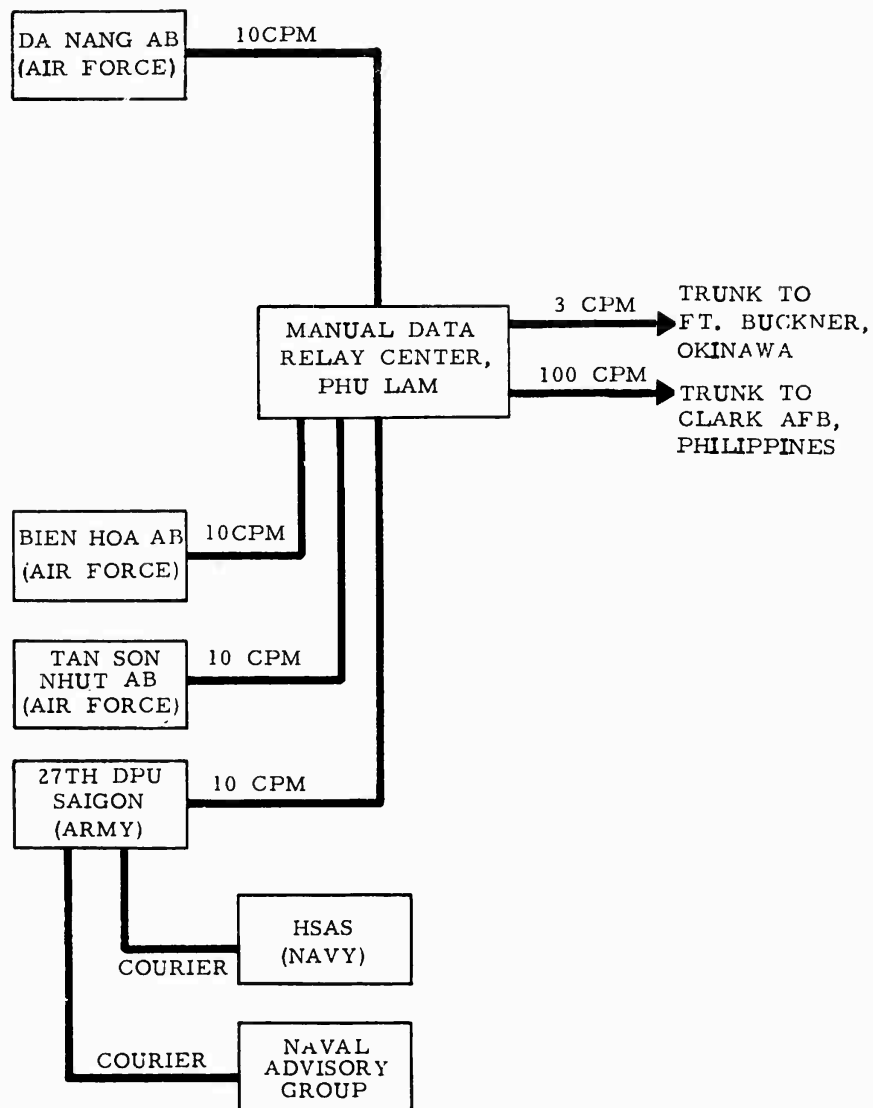


FIGURE E-1. INTERIM AUTODIN RVN - AUGUST 1965

Source: Air Force Communications Service, Communications in Southeast Asia (U), 31 July 1969, Figure II-2 (SECRET).

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c. Requirements. Requirements for data services in SE Asia followed, to a large extent, the growth of the supply activities in that area; and, as the logistic system began to take shape, plans were developed to provide data communications.

(1) The DCA System Plan for Extension and Upgrade of Interim AUTODIN Pacific in SE Asia, approved by the Secretary of Defense in December 1965, provided the basic guidance for the system that was implemented by the military departments from the end of 1965 until mid-1968, from the extension and buildup of the Manual Data Relay Centers (MDRC) until the activation of the present Pacific AUTODIN system. This plan provided the following major actions in RVN for data relays.¹⁷

(a) Upgrade of MDRC Phu Lam to provide additional service. MDRC, Phu Lam, would serve eight tributaries.

(b) Establishment of MDRC, Nha Trang, on an interim basis to serve the digital data tributaries north of Saigon. In addition, this would provide re-route capability in case of an operational failure at Phu Lam. MDRC, Nha Trang, would serve 17 tributaries.

(c) Establishment of two AUTODIN Automatic Switching Centers (ASC), one at Nha Trang and one at Phu Lam.

(2) The tributary configuration required to support the escalation of data needs in RVN was contained in DCA Implementation Plan Extension and Upgrade of Interim DCS AUTODIN, Pacific and SE Asia (publication date estimated as March 1966). This was based on a survey of RVN requirements, completed in September 1965, which compared capabilities against requirements (see Table E-2).¹⁸ Each Service was responsible for providing its own terminal equipment.

d. Implementing Actions. The previous establishment of the manual digital data communications capability in SE Asia had been accomplished by using low-speed commercial data transceivers, IBM 066, 067, and 068 equipment capable of 3 to 10 card per minute operation. The escalation of the conflict in 1965 increased the demands for both a higher volume of digital data traffic and improved speed of service for perishable data information.

(1) It was recognized that 066/068 equipment was incapable of meeting the increased requirements and both IBM 1013 equipment and UNIVAC 1004 equipment were brought into RVN for use with INTERIM AUTODIN. The IBM 1013 equipment provided a speed of 100 cards per minute, and the UNIVAC 1004 provided a speed of 200 cards per minute. These terminals were incompatible with the AUTODIN system, and as AUTODIN was implemented, the IBM equipment, the 066/068 and 1013s, were phased out. Owing to engineering problems the production schedule for the GFE AUTODIN terminals fell behind the installation of the AUTODIN Automatic Switching Centers.¹⁹ To provide terminal service for AUTODIN, modified UNIVAC 1004s and IBM 360/20 computers were used.

(2) The growth of the RVN data network can be seen from Figures E-1 through E-5, which show the implementation of both interim AUTODIN and AUTODIN through August 1968. The time-phased sequence of actions in this development is shown in Table E-1.

¹⁷ Air Force Communications Service, Communications in Southeast Asia (U), 31 July 1969, pp. II-4, 5 (SECRET).
Defense Communications Agency 1966 Commanders' Conference Report (U), September 1966, p. 180-1 (CONFIDENTIAL).

¹⁸ Air Force communications Service, Communications in Southeast Asia (U), 31 July 1969, Figure II-1 (SECRET).

¹⁹ Defense Communications Agency 1966 Commander's Conference Report (U), September 1966, p. 190-191 (CONFIDENTIAL).

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TABLE E-2

REQUIREMENTS FOR DATA SERVICE, VIETNAM AS OF 20 SEPTEMBER 1965
(CARDS PER MONTH)

<u>Tributary Station</u>	<u>Existing Capability*</u>	<u>Requirement</u>
1. Bien Hoa (Air Force)	130,000	850,000
2. Da Nang (Air Force)	100,000	750,000
3. Da Nang (Marines)	Through Da Nang	78,000
4. Nha Trang (Air Force)	None	570,000
5. Saigon (Army-27 DPU)	275,000	600,000
6. Tan Son Nhut (Air Force)	130,000	780,000
7. Vung Tau (Army)	None	165,000
	From same Terminal AF	25,000
8. Bien Hoa (Army)	None	75,000
9. Can Tho (Army)	None	
10. Binh Thuy (Air Force)	None	850,000
11. Da Nang (Army)	None	69,000
12. Da Nang (Navy)	None	
13. Phu Bai (Marines)	Through Da Nang	
14. Cam Ranh Bay (Air Force) Comm Center	None	950,000
15. Cam Ranh Bay (Air Force) Logistics	None	230,000
16. Cam Ranh Bay (Army)	None	950,000
17. Cam Ranh Bay (Navy)	None	
18. Chu Lai (Marines)	Through Da Nang	
19. Qui Nhon (Marines)	None	
20. Chu Lai (Air Force)	None	
21. An Khe (Army)	None	80,000
22. Pleiku (Air Force)	None	630,000
23. Qui Nhon (Army)	None	228,000
24. Qui Nhon (Air Force)	None	850,000
25. Nha Trang (Army)	None	198,000
26. Da Nang (East) (AF)	None	230,000
27. CSA Saigon (A)	None	579,000

*Capacity based on terminal and circuit capability for 24-hour operation.

Source: Air Force Communications Service, Communications in Southeast Asia (U),
31 July 1969, Fig. II-1 (SECRET).

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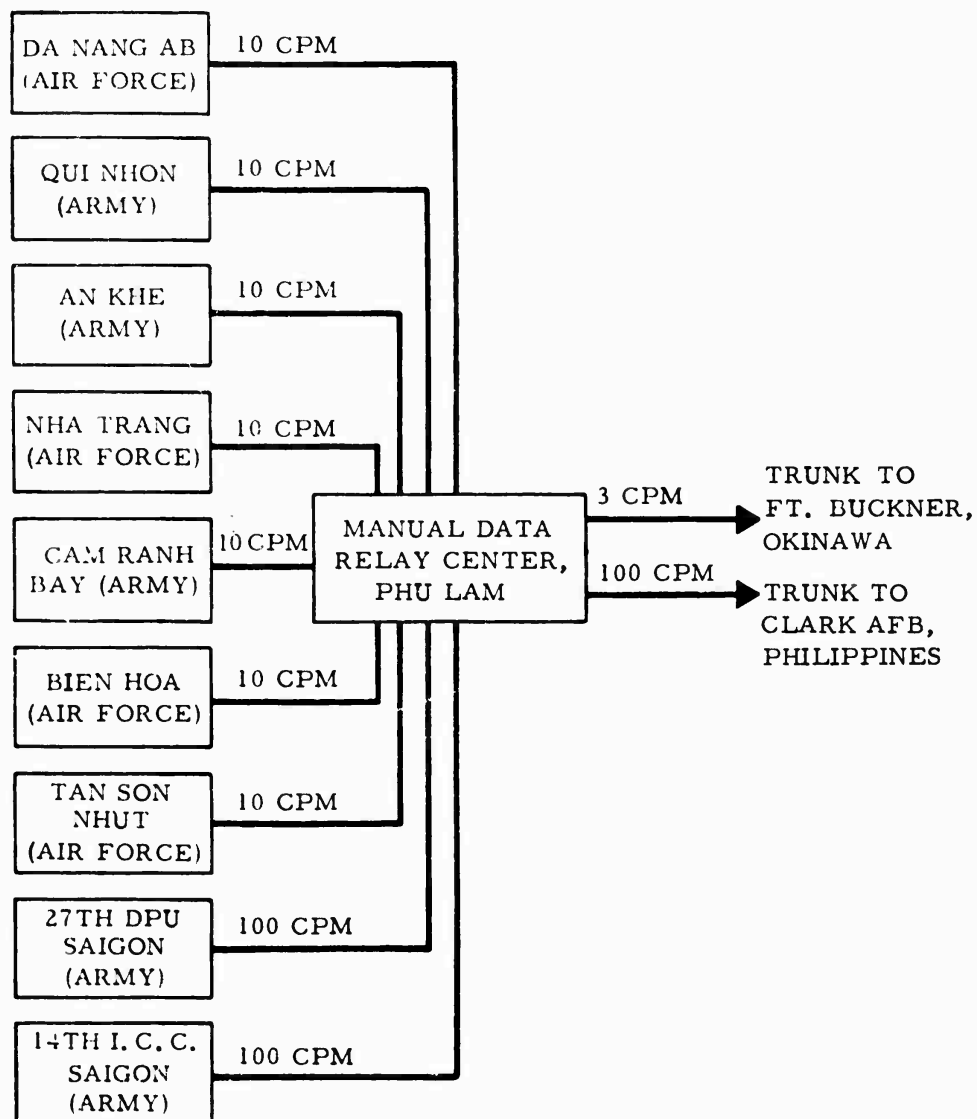


FIGURE E-2. INTERIM AUTODIN RVN - FEBRUARY 1966

Source: Air Force Communications Service, Communications in Southeast Asia (U), 31 July 1969, Figure II-8 (SECRET).

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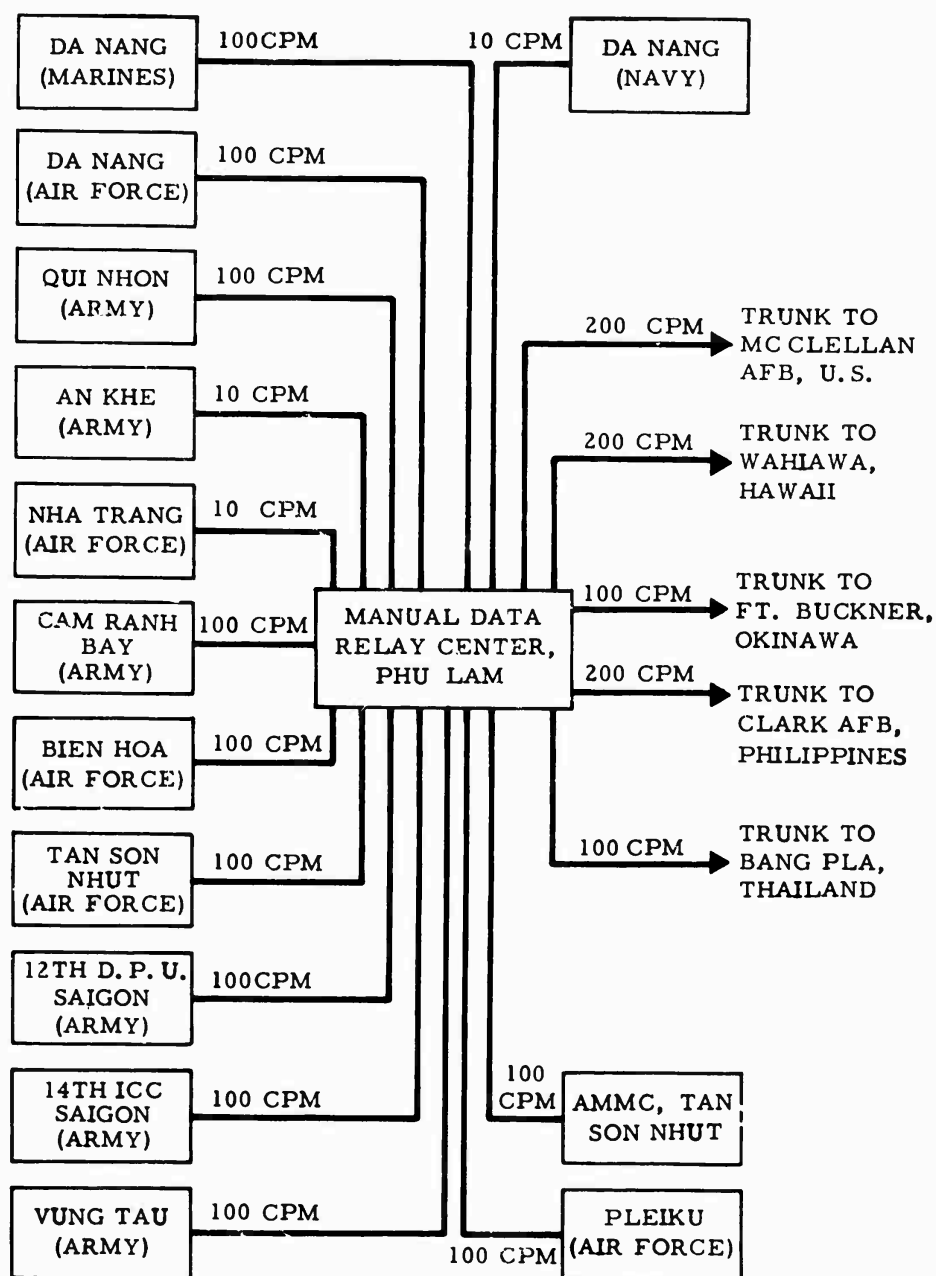


FIGURE E-3. INTERIM AUTODIN RVN - JULY 1967

Source: Defense Communications Agency, Southeast Asia Mainland Region Commanders' Report, 1 July 1966 - 1 July 1967 (U), Undated, Sec. II, Tab 1 (CONFIDENTIAL).

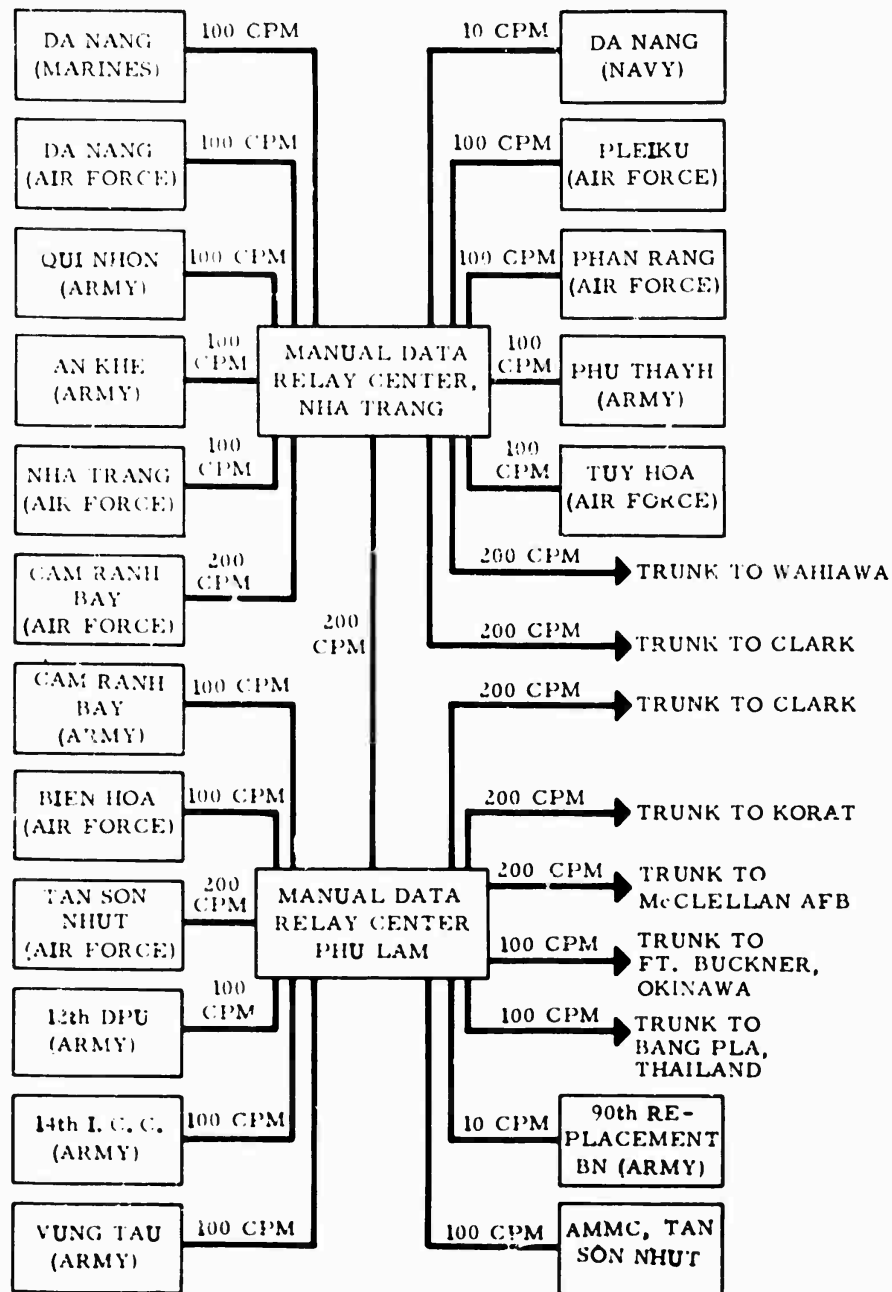


FIGURE E-4. INTERIM AUTODIN RVN - MARCH 1968

Source: Regional Communications Group, 1st Signal Brigade (STRATCOM) IWCS Orientation, 2d ed., 1 April 1968, Figure XIV-1.

PART I

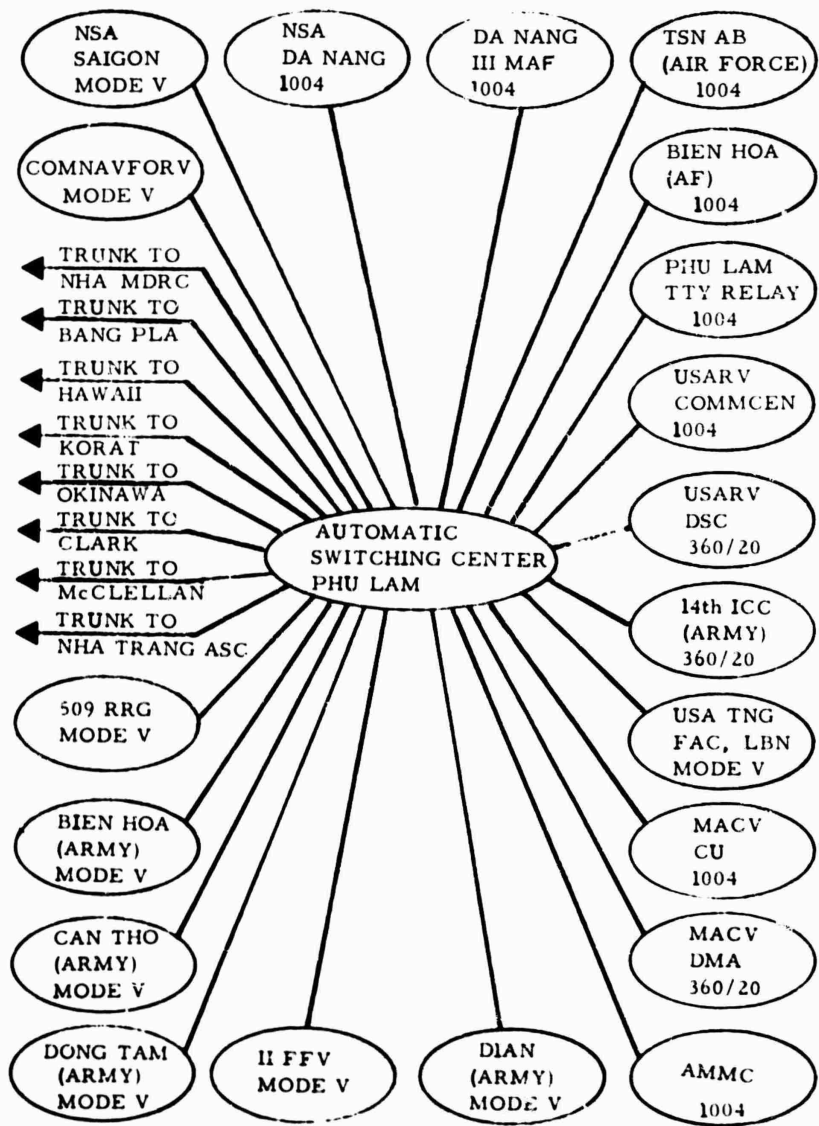


FIGURE E-5. DATA TRANSMISSION NETWORK RVN - OCTOBER 1968

Source: 1st Signal Brigade, Letter, subject: Operational Report of Headquarters, 1st Signal Brigade (USASIRATCOM) for Period Ending 31 October 1968 (U), 14 May 1968, Incls 4 and 5 (CONFIDENTIAL).

Nha Trang Signal Battalion, Communications Operating Performance Summary (U), October 1968 (CONFIDENTIAL).

PART II

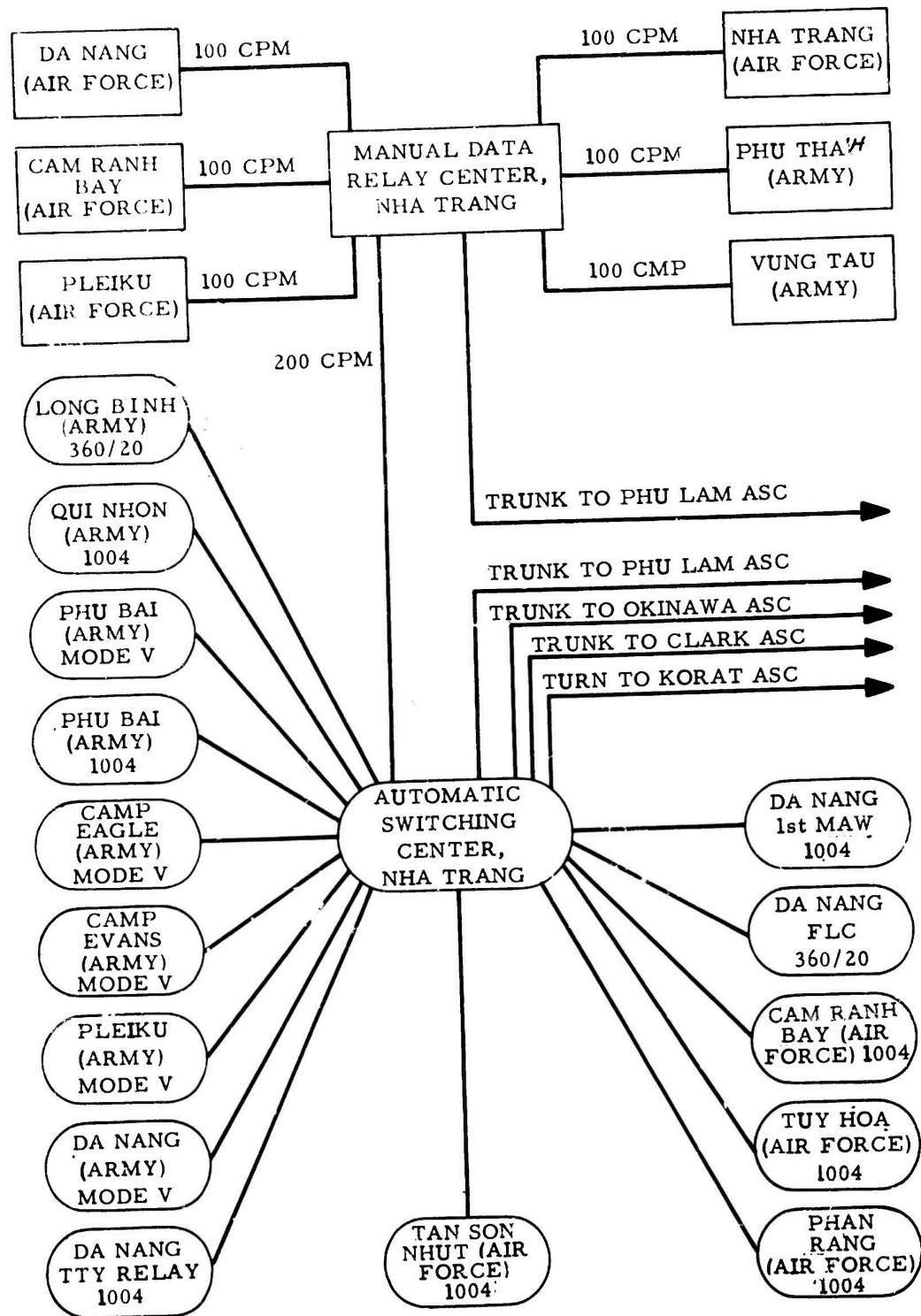


FIGURE E-5. DATA TRANSMISSION NETWORK RVN - OCTOBER 1968

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(a) This table shows, for the interim AUTODIN network, that from the time the plan was completed to provide the Manual Relay Center at Nha Trang, until this center was operational, 24 months had elapsed.

(b) For the AUTODIN network, this chart shows that from the time that DOD approved the plan to place AUTODIN Switching Centers in RVN, until the first switch was operational, 27 months had elapsed.

(3) The completion of the AUTODIN switches increased the traffic handling capability of the data switching centers and brought about a traffic shift from torn-tape teletype and manual data relays to the automatic data switches. (See Figure E-6.)²⁰

(4) The impact of the above on the user's activities can be seen by the experience of the Marines.²¹

(a) The arrival of the Data Processing Platoon at Da Nang in March 1965 gave Marine logistic elements the capability to employ automated data systems in their support effort. Initially this capability was restricted to the supply field, and inasmuch as all elements were located in the Da Nang Tactical Area of Responsibility (TAOR) no requirement existed for internal electrical transmission capabilities. However, as additional combat and combat support organizations established new enclaves, each requiring a logistic support organization, the need for a data communication system to extend from the primary source of supply on Okinawa to the logistic units serving them was recognized, and action was initiated to provide the necessary service.

(b) By May 1965 planning was underway and essential transceivers were being procured to establish an internal III MAF system and to enter the SE Asia INTERIM AUTODIN via the Air Force terminal at Da Nang. The latter arrangement was to be continued until a channel could be made available in the long-haul communication system that would permit the Force Logistic Support Group (FLSG) to become a tributary station itself out of the MDRC at Phu Lam.

(c) At this time automatic data processing in the Marine Corps was used primarily in support of supply activities, and the data processing platoons were not associated with communications except as subscribers. This situation did not change until October 1966 when the Force Logistic Command CEO assumed responsibility for the INTERIM AUTODIN terminal for that command.

(d) The following is a brief resume' of the development of data transmission systems in III MAF:

²⁰ Defense Communications Agency, 1966 Commanders' Conference Report (U), September 1966, pp. 88-90 (CONFIDENTIAL); Presentation by Chief, DCA - Pacific to the DCA Commanders' Conference, 5 October 1967, Chart 14 (CONFIDENTIAL); Phu Lam Signal Battalion, Communications Operations Performance Summary (U), March 1968, pp. 21, 25 (CONFIDENTIAL); Phu Lam Signal Battalion, Communications Operations Performance Summary (U), July 1968, pp. 8, 25; Phu Lam Signal Battalion, Communications Operations Performance Summary (U), February 1969, pp. 13, 35 (CONFIDENTIAL); Nha Trang Signal Battalion, Communications Operations Performance Summary (U), April 1968, pp. 14, 18 (CONFIDENTIAL); Nha Trang Signal Battalion, Communications Operations Performance Summary (U), July 1968, pp. 18, 22, 28 (CONFIDENTIAL); Nha Trang Signal Battalion, Communications Operations Performance Summary (U), January 1969 (CONFIDENTIAL); Nha Trang Signal Battalion, AUTODIN ASC (RUM) Communications Operations Performance Summary (U), January 1969, p. 22 (CONFIDENTIAL); Da Nang Signal Battalion, Communications Operation Performance Summary (U), December 1968, p. 13 (CONFIDENTIAL); Da Nang Signal Battalion, Communications Operations Performance Summary (U), January 1969 (CONFIDENTIAL).

²¹ CGFMFPAC, Letter, subject: Joint Logistics Review Board Requirement, 21 June 1969.

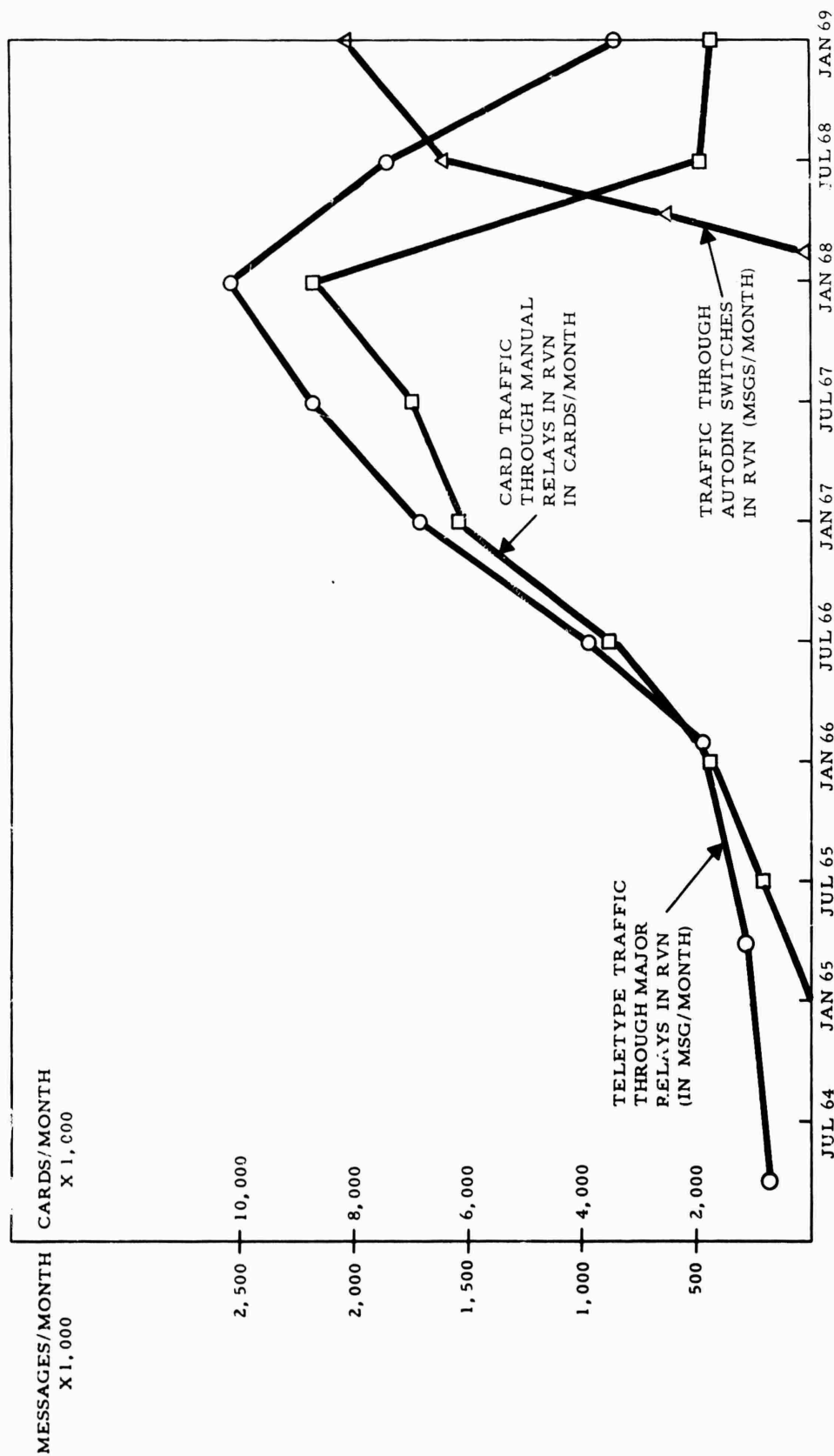


FIGURE E-6. COMMON-USER TRAFFIC IN RVN MAJOR RELAYS

1. May 1965. Plans were initiated to enter the SE Asia INTERIM AUTODIN by FLSG and to establish an internal data net serving FLSG, Force Logistic Service Unit - 1 (FLSU-1) (Chu Lai), and FLSU-2 (Phu Bai). Pending availability of a channel to the Phu Lam Manual Data Relay Center, the Air Force tributary station at Da Nang was to provide entry into the worldwide systems.

2. January 1966. The FLSG to FLSU-1 net was activated. It was marginal in quality. The FLSG to FLSU-2 net was also activated but proved to be unsatisfactory and was closed down after brief attempts at operation. All nets used DCS circuits and IBM 066/068 transceivers with a speed of approximately 10 CPM. The Air Force continued to provide entry into the worldwide system. Error rates in out-of-country transmission plus lost batches and extensive delays required that duplicates of all cards be flown to and from Okinawa by air courier.

3. June 1966. FLC/FLSG-A entered the SE Asia INTERIM AUTODIN as a tributary station of the Phu Lam MDRC. The delay was the result of awaiting a circuit activation order from DCA, cable construction, and equipment installation at FLSG. The Chu Lai net was marginal, whereas the Phu Bai net remained inoperable because of faulty 066/068 equipment, general operational problems at Phu Bai, and the fact that the circuit path would not hold for data transmission.

4. October 1966. FLC/FLSG-A Communications-Electronics Officer (CEO) assumed responsibility for INTERIM AUTODIN functions. An IBM 1013 circuit was installed at Nha Trang. This circuit was marginal because of the length of cable run from FLC to Da Nang IWCS. A marginal data circuit was established to Phu Bai, operating at 10 CPM.

5. March 1967. The Naval Shore Electronics Engineering Activity, Pacific (NAVSEEPAC) completed installation of a new 100 CPM IBM 1013 facility at FLC.

6. May 1967. The IBM 1013, with a 100 CPM capacity, was placed in operation on the interim AUTODIN, replacing the previous circuit. Similar equipment was planned for the FLC internal net when available.

7. June 1967. Data communications with Phu Bai remained marginal; primary reliance was placed on courier runs to deliver card batches. The First Marine Aircraft Wing (MAW) sent many card batches to Naval Air Station (NAS) Cubi Point, Philippines, their Aviation Supply Point.

8. October 1967. III MAF entered the interim AUTODIN system for the transmission and receipt of narrative message traffic using Univac 1004 equipment.

9. January 1968. FLSG-B moved from Chu Lai to Dong Ha, but without data processing support. Supply Co (-) 1st Force Service Regt. assumed support functions in the Chu Lai Tactical Area of Responsibility (TAOR), including data transmission.

10. April 1968. FLC activated its AUTODIN terminal for the transmission of narrative message, card, and magnetic tape data. This terminal employed an IBM 360/20 computer. At the same time, communications circuits to Phu Bai and Chu Lai were improved and IBM 1013 equipment was installed on the internal data net.

11. October 1968. The 1st Marine Aircraft Wing at Da Nang activated its AUTODIN terminal.

5. **PROBLEMS**. The following problems were met during the message-switching networks buildup. These are considered important because they can be expected to reoccur in a similar situation.

a. Data Circuit Quality Requirements. Circuits that were adequate for voice or teletype were not adequate for data.

(1) Construction of commercial card transceivers was based on the availability of quality circuits; i.e., the circuit would not be heavily contaminated by random or impulse noise. Thus the commercial card transceivers did not include anything more than rudimentary error detection circuitry, e.g., parity checks. The use of this equipment in Vietnam depended on the availability of DCS quality circuits.²² However, when the equipment was placed in an environment where DCS quality circuits were not available, substantial difficulties were encountered.

(2) The need for the tactical commander in Vietnam to communicate required DCS quality circuits. The tactical commander did need equipment that could be emplaced rapidly and could provide a basic voice and teletype capability from a site near his headquarters. Because of the need to displace these tactical systems quickly, they could not undergo the long emplacement time required to produce quality circuits, even if the sites on which the terminals were located, due to tactical reasons, could have provided a propagation path capable of providing quality channels.

(3) The results of the above were:

(a) The data transceivers were designed assuming that a DCS quality circuit would be available.

(b) The DCS quality circuits did not become available until completion of substantial portions of the fixed-plant IWCS and 439L project (approximately July - December 1967). (See Appendix C.)

(c) The only circuits initially available were derived from tactical links that could not provide the circuit quality required. Use of these circuits caused a data transmission error rate that was unacceptable to the users, resulting in extensive use of couriers to hand-carry card traffic.²²

b. Use of Commercial Equipment. In addition to the need for quality circuits, other implications of the extensive use of commercial equipment in a combat zone included:

(1) Substantial maintenance problems including lack of spare parts and trained maintenance personnel.

(2) Additional logistical requirements to provide a controlled environment. Successful operation of the card transceivers required that the environment in which they were placed be controlled in terms of temperature, humidity, and dust. This required air conditioning and substantial additional electrical power to operate the air conditioning equipment.²³

c. Logistic Problems. Except where the installations were in existence and completely self-contained, problems arose in providing necessary buildings and power.

²²The DCS standards are based on the need to provide a 6000-nautical mile circuit and place extremely high standards on the quality of the circuit. This requirement is currently under consideration to be increased to a 12,000-nautical mile distance as detailed in Defense Communications Agency, Circular 300-R-205-37.

²³For example, Red Ball requisitions were carried by air courier from Long Binh, RVN to Fort Mason, California, as a normal method of doing business, during early 1967. (U.S. Army Audit Agency, Pacific District, Audit Report No. PA 67-69, Requisition Processing and Related Flow of Material in Vietnam, 5 May 1967, p. 16.)

²⁴As a rough order of merit, it takes twice as much electrical power to remove the heat that is caused by a specific load. Thus, for example, a punch card machine that required 3 kw to operate implied a total electric power of 9 kw. The additional 6 kw was required to operate the air conditioner.

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6. IMPACT. The overall impact of the above was that:

a. A lack of communications discipline on the part of the users adversely affected the capability of the teletype networks to provide reasonable service to the users, although the deployment of contingency equipment and its subsequent replacement with fixed-plant stations did provide a gradually increased capability. This problem was resolved by the cutover of the AUTODIN switches from March to June 1968.

b. Substantial delays were encountered in providing electrical transmission of data traffic. Up through July 1967, a period in excess of 2 years after the decision was made to buildup the force structure in RVN, air courier was still one of the major means used to pass card traffic. This problem was resolved by the provision of fixed-plant quality links by the IWCS and 439L projects.

APPENDIX F

COMMUNICATIONS EQUIPMENT DESCRIPTIONS

1. PURPOSE. The purpose of this appendix is to provide brief descriptive material on each of the major communications items mentioned in this monograph. This is provided for familiarization only. For authoritative, detailed information, the basic source material should be consulted.¹

2. GENERAL. The material used in RVN can be separated into different categories.

a. Tropospheric Scatter Radio (Tropo). This is further divided into heavy tropo and light tropo.

(1) Heavy Tropo. This is considered to be those tropo sets which provide a transmitter output power of 10 kw. Two different types were used in RVN.

(a) AN/MRC-85

1. Reference. Air Force TO 31R5-2MRC85-2.

2. General Information. The AN/MRC-85 is a transportable tropospheric scatter radio terminal mounted in three semitrailer vans, M-373A2. This is an Air Force unique item of issue whose configuration of components and equipment depends on the operational requirement for a specific number of channels and the distance between terminals. The AN/MRC-85s deployed to RVN used 60-foot parabolic fixed antennas. All of the AN/MRC-85s used in Vietnam provided 72 voice channels except those used on the WET WASH link between Saigon (Phu Lam) and Nha Trang, which provided 60 voice channels. Technical characteristics are as follows:

Frequency range:	750 - 985 MHz
Planning range (Km):	320
Power Requirements (furnished as part of set):	150 kw

(b) AN/MRC-98. The AN/MRC-98 is similar to the AN/MRC-85 except that it provides 60-voice channels and uses 28-foot parabolic transportable antennas.

(2) Light Tropo. These are those tropo sets that provided a transmitter output power of 1 kw.

(a) AN/TRC-90, (A), (B)

1. References

TM 11-5820-512-12 (AN/TRC-90)
TM 11-5820-524-12 (AN/TRC-90A)
TM 11-5820-519-12 (AN/TRC-90B)

¹The communications equipment used in Vietnam was, in some cases, modified substantially to provide a different or expanded capability than originally provided. The material herein reflects these RVN modifications.

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2. General Information. The AN/TRC-90 is a transportable tropospheric scatter radio terminal mounted in a S-141 shelter together with a trailer-mounted power unit. This provides 24 voice channels. The AN/TRC-90A and the AN/TRC-90B are similar to the AN/TRC-90 except for the type of antennas used and other minor changes. Technical characteristics are as follows:

Frequency range:	4.4 to 5.0 gc
Planning range (Km):	160
Power requirements (furnished as part of set):	15 kw

(b) AN/TRC-97

1. References

USMC SL-4-04041A
USMC SL-3-04041A

2. General Information. The AN/TRC-97 is similar to the AN/TRC-90. Different models provide 12 or 24 voice channels. The AN/TRC-97 can be used at low power (1 watt) as a microwave line-of-sight terminal.

b. Line-of-sight Radio. Radio sets using line-of-sight propagation paths include:

(1) AN/GRC-50

(a) Reference. TM 11-5820-461-10.

(b) General Information. The AN/GRC-50(v) is a transportable radio set designed to use in intermediate and rear areas. It may be used with 4-, 12-, or 24-voice channel equipment. Technical characteristics are as follows:

Frequency range:	Low band: 601.5 - 999.5 mc High band: 1350.5 - 1849.5 mc
Transmitter power (w):	Low band: 15-30 High band: 8-20
Planning range (km):	40 to 48
Total Weight:	Approximately 400 lbs.

(2) AN/MRC-54/69/73

(a) References

TM 11-5820-203-15 (AN/MRC-54)
TM 11-5820-204-15 (AN/MRC-69)
TM 11-5820-221-15 (AN/MRC-73)

(b) General Information. The AN/MRC-54/69/73 are configurations of AN/TRC-24 radio (see below) and 12-voice channel multiplexing equipment. These provide relay (AN/MRC-54), single-terminal (AN/MRC-73), or double-terminal (AN/MRC-69) service. Each is mounted in an S-141 shelter on a 2 1/2-ton truck with the associated power units mounted in a towed trailer.

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(3) AN/TRC-24

(a) Reference. TM-11-520-287-10.

(b) General Information. The AN/TRC-24 is a transportable radio set used primarily at division (limited Corps and Army) level. Configurations of the AN/TRC-24 are normally used with 12-voice channel equipment. Technical characteristics are as follows:

Frequency range:	A Band: 50 - 100 mc B Band: 100 - 225 mc C Band: 225 - 400 mc D Band: 400 - 600 mc F Band: 790 - 925 mc J Band: 1,340 - 1,875 mc
Transmitter power (w):	10 to 120
Planning range (km):	40 to 48
Total Weight:	340 lbs.

(4) AN/TRC-29

(a) References

TM 11-689
TM 11-2682

(b) General Information. The AN/TRC-29 is a transportable radio set for use in field or fixed installations. It may be used with either 23- or 45-voice channel equipment. Technical characteristics are as follows:

Frequency range:	1.7 to 2.4 gc
Transmitter power (w):	10
Planning range (km):	40 to 48
Total weight:	1,050 lbs.

c. High-Frequency Radio. This includes:

(2) AN/GRC-26

(a) Reference. TM 11-5820-202-10.

(b) General Information. The AN/GRC-26 is a 400 watt, high-frequency radio terminal with associated power supply mounted in a towed trailer. This provides either one voice or one teletype channel. When mounted in a 2 1/2-ton truck, it can be designated as the AN/MRC-32.

(1) AN/TRC-136. The AN/TRC-136 is a 1-kw high-frequency radio terminal. This provides three voice and 16 teletypewriter channels. The equipment is installed in a S-318/G shelter mounted on a 3/4-ton truck with the associated power units mounted in a towed trailer.

(3) AN/TSC-18. The AN/TSC-18 is a communications complex consisting of a communications center and a 40-kw high-frequency independent-sideband radio terminal. This

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furnishes three voice and 16 teletypewriter channels and is used to provide contingency access to the Defense Communications System. This consists of three shelters (S-141) and one semi-trailer van (M-373 A2C), and six power units mounted on trailers. Total weight is approximately 70,000 pounds.

(4) AN/TSC-19. The AN/TSC-19 is essentially the same as the AN/TSC-18 (see above) except for a lower power (10 kw) high-frequency transmitter mounted in a shelter instead of a van. Total weight is approximately 55,000 pounds.

(5) AN/TSC-38. The AN/TSC-38 is a communications complex providing high-frequency single sideband radio channels, a telephone terminal and switching center for 12 telephone lines, a teletypewriter terminal and switching center for 20 teletypewriter lines and two full duplex cryptographic channels. The primary radio contains a 10-kw transmitter. The secondary radio contains a 1-kw transmitter. Each radio provides three voice channels and 16 teletypewriter channels. This consists of one shelter and one auxiliary trailer mounting the power equipment. Total weight is approximately 19,000 pounds.

(6) AN/VSC-2. The AN/VSC-2 is a 400-watt, high-frequency radio terminal. This provides either one voice or one teletype channel. It is mounted on a 1/4-ton vehicle and uses the vehicular power supply.

d. Satellite Communications Terminals. These include:

(1) AN/MSC-44. The AN/MSC-44 is a transportable satellite communications terminal providing one voice and one teletypewriter channel via the SYNCOM Satellite Communications System. This consists of 11 vans and 2 trailers, with a total weight of 370,000 pounds.

(2) AN/MSC-46. The AN/MSC-46 is a transportable satellite communications terminal providing 11-voice channels via the Defense Communications Satellite System. This consists of 4 vans and 3 trailers (mounting power units). Total weight of vans and trailer is 125,000 pounds.

(3) AN/TSC-54. The AN/TSC-54 is a transportable satellite communications terminal providing one voice and one teletype channel via the Defense Communications Satellite System. This consists of one shelter and two trailers. Total weight is approximately 24,000 pounds.

e. Telephone Switchboards

(1) AN/MTC-1

(a) Reference. TM 11-5805-284-15.

(b) General Information. The AN/MTC-1 is a manual three-position telephone switching facility that provides terminations for 200 local- or common-battery subscriber circuits, and for 20 manual or dial trunks. The AN/MTC-1 consists of two modified S-141 shelters in which are mounted components of the AN/TTC-7 (see below). Weight of each complete shelter is 4,500 pounds. Total power consumption is 8 kw.

(2) AN/MTC-9

(a) Reference. TM-5805-288-15.

(b) General Information. The AN/MTC-9 is a manual nine-position telephone switching facility that provides terminations for 600 local- or common-battery subscriber circuits and 60 manual or dial trunks. The AN/MTC-9 consists of two 5-ton semitrailer vans, M-348, in which are mounted components of the AN/TTC-7 (see below). Weight of each van is approximately 19,000 pounds. Total power consumption is 19 kw.

(3) AN/TTC-7

(a) Reference. TM 11-2146.

(b) General Information. The AN/TTC-7 is a manual three-position telephone switching facility that provides terminations for 200 local lines and 40 trunk circuits. It may be van-mounted as a mobile central office, or installed in a building as a semipermanent central office. The AN/TTC-7 may be expanded to handle 1,160 lines by adding components.

(4) AN/TTC-22. The AN/TTC-22 is a switching facility that provides both 100-line automatic and 120-line two-position manual service. The equipment is mounted in an H-583 shelter; total weight is 6,750 pounds. This is not a standard item of issue.

(5) AN/TTC-25. The AN/TTC-25 is an automatic dial central office that provides termination for 600 telephone circuits. The AN/TTC-25 consists of one shelter in which is mounted solid-state switching equipment. This is currently under development.

(6) AN/TTC-28. The AN/TTC-28 is an automatic dial central office that provides termination for 600 telephone circuits. The AN/TTC-28 consists of two 10-ton semitrailer vans which are mounted commercial step-by-step equipment. Weight of each van is approximately 31,000 pounds.

(7) AN/TTC-30. The AN/TTC-30 is an automatic solid-state dial central office that provides terminations for 374 lines. The AN/TTC-30 consists of two shelters in which is mounted the equipment. The AN/TTC-30 is being provided as part of the Air Force 407L Program.

(8) AN/TTC-31

(a) Reference. Headquarters, Marine Corps, Letter of Adoption and Procurement Number 57-67.

(b) General Information. The AN/TTC-31 is an electronic dial telephone switching central that provides termination for up to 600 two wire or four wire telephone circuits. The AN/TTC-31 consists of one shelter in which is mounted solid-state switching equipment. This is currently under development.

(9) SB-22

(a) Reference. TM 11-5805-262-12.

(b) General Information. The SB-22 is a lightweight tactical manual (mono-cord) switchboard that can be rapidly installed to provide field facilities for interconnecting 12 local-battery telephone circuits. The SB-22 can be expanded in the field to handle 27 circuits. Total weight is approximately 30 pounds.

(10) SB-86

(a) References

TM 11-2134
TM 11-4134

(b) General Information. The SB-86 is a lightweight tactical manual single position switchboard that can be rapidly installed to provide field facilities for interconnecting 30 local- or common-battery telephone circuits. The SB-86 can be expanded in the field to handle 60 circuits; total weight is approximately 180 pounds.

f. Multiplex Equipment

(1) AN/FGC-60. The AN/FGC-60 is a frequency-shift telegraph multiplex equipment capable of providing up to 16 full-duplex teletype (100 words per minute) circuits over one voice channel.

(2) AN/TTC-13

(a) Reference. TM 11-2141.

(b) General Information. The AN/TTC-13 is a pulse position modulation multiplex equipment capable of providing up to 45 voice channels over a single RF channel.

g. Teletype Facilities

(1) AN/TSC-48/50. The AN/TSC-48/50 is a combined pair of transportable communications assemblages, which together provide a secure-circuit teletypewriter tape relay center. Each of these is contained in a separate semitrailer van, M-373A2C. Weight of each unit is approximately 20,000 pounds. Total power requirements are 65 kw.

(a) The AN/TSC-48 contains the termination facilities for 18 full-duplex nonencrypted DC semiautomatic torn-tape teletypewriter circuits.

(b) The AN/TSC-50 contains cryptographic equipment.

(2) AN/TSC-64. The AN/TSC-64 is a teletypewriter terminal facility that provides terminations for two full-duplex secure teletype circuits. The equipment is mounted in an S-144 shelter mounted on a 3/4-ton truck, with the associated power units mounted in a towed trailer.

(3) AN/TSC-65. The AN/TSC-65 is a teletypewriter terminal facility that provides terminations for six full-duplex secure teletypewriter circuits. The equipment is mounted in a S-28 shelter, on a GOAT mobilizer. The associated power units are mounted in the bed of a 2 1/2-ton truck that tows the GOAT.

h. Contingency Packages

(1) Air Transportable Communications Unit 100A (ATCU-100A). The ACTU 100A is a transportable communications complex providing: one SSB FDM 16-channel teletype plus three SSB voice circuits; two SSB HF voice CW circuits; one UHF and one VHF voice or HF RATT circuits; one VLF receive-only capability; and a semiautomatic relay facility to accommodate eight duplex teletype circuits. These are mounted in five van-type shelters.

(2) CINCPACFLT Contingency Communication Packages 3 and 4. These are portable packages composed of standard Navy communications equipment mounted in six boxes and provide one full-duplex on-line radio teletype circuit and one voice channel with 100 percent backup capability for each.

i. Miscellaneous. SB-611

(1) Reference. TM 11-5805-204-15.

(2) General Information. The SB-611 is a circuit control facility that permits patching (routing and re-routing), testing, and monitoring voice teletype circuits. The equipment is installed in a modified S-144/G shelter that is mounted on a 3/4-ton truck. Power requirements are 2 kw.

APPENDIX G

LIST OF ACRONYMS AND ABBREVIATIONS

AF	Air Force
AID	Agency for International Development
AMMC	Aviation Material Maintenance Center
ASC	Automatic Switching Center
ATCU	Air Transportable Communications Unit
AUTODIN	Automatic Digital Network. A worldwide automatic communication system that provides automatic data service for the Department of Defense (DOD) and certain, non-DOD subscribers. It is a general-purpose network of the Defense Communications System.
AUTOSEVOCOM	Automatic Secure Voice Communications. Consists of a number of automatic and manual secure voice switches that provide main line trunking from Defense Communications System facilities and direct distance dialing service to certain subscribers of the Department of Defense and the National Communications System.
AUTOVON	Automatic Voice Network. An automatic circuit switching network that offers rapid, direct voice quality interconnection for military and other installations in continental United States and certain overseas areas.
BACK PORCH	A tropospheric scatter radio system in Vietnam
CEO	Communications-Electronics Officer
CINCPAC	Commander in Chief, Pacific
COMSAT	Communications Satellite Corporation
COMUSMACV	Commander, U.S. Military Assistance Command, Vietnam
CPM	cards per minute
DA	Department of the Army
DCA	Defense Communications Agency
DCA-PAC	Defense Communications Agency, Pacific
DCO	dial central office
DCS	Defense Communications System
DOD	Department of Defense

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DPU	Data Processing Unit
FLC	Force Logistic Command
FLSG	Force Logistic Support Group
FLSU	Force Logistic Support Unit
GFE	Government-furnished equipment
HF	high-frequency
HSAS	Headquarters, Support Activity, Saigon
ICC	Inventory Control Center
IDCSP	Initial Defense Communications Satellite Program, a Defense Department project
interim AUTODIN	The network used for manually relaying punched cards via electrical transmission
IWCS	Integrated Wideband Communications System. An Army project that provided communications links via tropo and microwave radio in Vietnam
JCS	Joint Chiefs of Staff
JOSS	Joint Overseas Switchboard
MAAG	Military Assistance Advisory Group
MACV	Military Assistance Command, Vietnam
MAF	Marine Amphibious Force
MAW	Marine Aircraft Wing
MDRC	Manual Data Relay Center
MODE V	An AUTODIN terminal used for narrative traffic
MOS	Military Occupational Speciality
NAVCOMMSTA	Naval Communications Station
NAVSEEAPAC	Naval Shore Electronics Engineer Activity, Pacific
OICC	Officer in Charge of Construction
RATT	Radio-Teletype
RRG	Radio Research Group
RVN	Republic of Vietnam
SSB	single sideband

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SOUTHERN TOLL	An AID project that provided commercial communications links via microwave radio in Vietnam
SPEED QUEEN	A project to modernize and expand the DCS facilities in the Philippines
SYNCOM	A satellite program transferred from NASA to DOD that provided one voice and one teletype channel to RVN
TAOR	Tactical Area of Responsibility
TRANSPAC	A submarine cable connecting the Philippines with Guam and Hawaii
tropo	tropospheric scatter radio
USARPAC	United States Army, Pacific
USASTRATCOM	U.S. Army Strategic Communications Command
USSTRICOM	U.S. Strike Command
VHF	very high frequency
VLF	very low frequency
WESTPAC	Western Pacific
WET WASH	A 60-voice channel submarine cable connecting Nha Trang, RVN, with the Philippines
WPM	words per minute
439L	An Air Force project that provided communication links via coastal submarine cable between sites in Vietnam and Thailand
360/20	IBM 360/20, commercial equipment used as an AUTODIN Terminal
1004	UNIVAC 1004, commercial equipment used both as an AUTODIN and as an INTERIM AUTODIN Terminal
1013	IBM 1013, commercial equipment used as an interim AUTODIN Terminal

APPENDIX H

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